PROCESS MAPPING A DIMINISHING MANUFACTURING SOURCES AND MATERIEL SHORTAGES REACTIVE MANAGEMENT STRATEGY: A CASE STUDY

THESIS

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Most importantly, I would like to dedicate this work to my lovely wife and my two wonderful sons. The sacrifices that my family has made over the last six years for both my career and for my education will never be forgotten.

"I can do all things through Christ which strengtheneth me." Philippians 4:13

Robert E. Overstreet

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Abstract

With the United States military representing an ever-shrinking share of the electronics market, Diminishing Manufacturing Sources and Materiel Shortages (DMSMS) represents both a threat to mission capability as well as a large expenditure to maintain aging military weapon systems. As the primary manager of Federal Stock Classes 5961 and 5962, the Defense Supply Center, Columbus (DSCC) confronts the largest number of DMSMS cases. Their resolution of DMSMS cases affects nearly every fielded weapon system. This thesis sought to determine if the management strategy used by the DSCC could be improved.

A qualitative case study design was used to collect and evaluate the data for this effort. The products produced for the sponsor were a cross-functional process map of their DMSMS management strategy and an updated supplement to Defense Logistics Agency (DLA) Regulation 4005.6 *Diminishing Manufacturing Sources and Materiel Shortages (DMSMS) Program*.

Based on the evaluation of the process, the researcher's recommendations for improvement are to focus on primary output and work to decrease the call for secondary output, perform "as-requested" services for non-DSCC items, reduce the bureaucracy between DSCC and the services' Engineering Support Agencies, and provide case resolution information to the customer.

PROCESS MAPPING A DIMINISHING MANUFACTURING SOURCES AND MATERIEL SHORTAGES REACTIVE MANAGEMENT STRATEGY: A CASE STUDY

I. Introduction

Background

Diminishing Manufacturing Sources and Materiel Shortages (DMSMS) is the loss, or impending loss, of the last known manufacturer or supplier of an item or the shortage of raw materiel needed to support a weapon system. DMSMS can happen at any time in the life cycle of a system, from design to operations and support, jeopardizing readiness and drastically increasing total ownership costs. DMSMS is not limited to individual items or parts. It can affect weapon systems at any level of indenture.

Air Force Materiel Command's (AFMC's) DMSMS *Case Resolution Guide* states that most DMSMS problems occur within the area of electronic components, primarily Federal Stock Class (FSC) 5961, semiconductors, and FSC 5962, microcircuits; however, DMSMS can and does affect all other FSCs (AFMC, 2001:1). Through much of the additional literature reviewed, electronics components, particularly microcircuits, comprise the overwhelming majority of DMSMS cases.

The environment in which the military functions exacerbates the DMSMS phenomenon. In the mid 1970s, the Department of Defense represented nearly 18 percent of the microelectronics market. In recent years, DoD market share has dropped to ½ of 1 percent (DMEA, 2001). This means that demand for electronics is composed

almost entirely of the civilian market. Another problem is that most of the major DoD weapon systems are already well beyond their notional projected lifetime. The U. S. Military has weapon systems that achieved Initial Operational Capability (IOC) in the late 1950s with an extended life as late as 2040. These systems have consumed many times their initial numbers of support spares. Failure rates are increasing rapidly at the same time spares stocks are being depleted. Through the 1990s, the U. S. military was asked to do more with less. According to DefenseLINK News, the defense budget went from $383 billion in 1990 to $280 billion in 2000, a 27% reduction. Fortunately, the military has confronted Congress with the effects of the last decade and requested a $109 billion budget increase over the next six years. However, the far-reaching effects of the "do more with less" decade have yet to be seen.

While the argument has often been made that "DMSMS is increasing," we have yet to demonstrate that empirically. As for the Defense Supply Center, Columbus (DSCC), a review of the last 10 years of DMS case history indicates that there is not an identifiable trend in the number of cases. However, in the data several peaks stand out. The two largest peaks are attributable to large electronic component manufacturers (e.g., Philips, Motorola, and AMD) discontinuing production of military specification components (Shkane, 2001a).

The single most important factor contributing to DMSMS is the commercial profit motive of manufacturers (NAVSEA, 2001:1; Robinson, 2001a). Companies focus their efforts on producing items that are profitable. From the manufacturers' perspective, rapidly changing technologies, increased foreign competition, federal environmental and safety regulations, and/or limited availability of materiel may make continued production

of selected items uneconomical or otherwise unattractive (DMEA, 2001). In the electronics market, rapidly changing technology and the shrinking market share of the DoD does not provide the profit incentive to stay in production that it once did.

The smaller DoD market share, the aging of DoD weapon systems, the reduced military spending, and the increased competition in the civilian market encourage new product development rather than continued support of older technologies.

As with any military specialty, the acquisition, engineering, and inventory management personnel who work in the area of DMSMS have developed their own unique language. Appendix A provides a short list of the most common acronyms related to DMSMS.

Problem Statement

In the Department of Defense (DoD), there is increased interest in reducing total ownership costs, and increasing the availability of its aging weapon systems. The DoD is continually forced to extend weapon system service life well beyond the intended service life. Effective program management that incorporates proactive approaches such as open architecture and the use of commercial-off-the-shelf items during the first stages of a program's life cycle can reduce some of the effects of later DMSMS issues.

For mature programs that are in the operation and support phase, the Integrated Materiel Manager (IMM) must counter DMSMS problems with the most cost effective reactive approach or resolution alternative that ensures program viability. As the primary IMM for FSC 5961 and FSC 5962, the DSCC confronts the largest number of DMSMS cases. Their resolution of DMSMS cases affects nearly every fielded weapon system.

Because of the realignment of DMSMS responsibilities within DSCC that took place nearly a year ago, there is not a current, formally documented DSCC DMSMS reactive management strategy.

Research Questions

The purpose of this research effort is contained within the overall research question, "Can the current DMSMS management strategy used by DSCC be improved?" To answer this high-level, over-arching question, several sub-questions (listed below) must first be answered.

1. What is the current DSCC DMSMS management strategy?
2. What agencies, initiatives, and tools are being incorporated in their strategy?
3. What are the current issues/problems/limitations with their strategy?
4. How could their strategy be improved?

Specific investigative questions will further refine the areas of inquiry and provide the necessary information to answer each sub-question. The investigative questions are discussed later in the thesis.

Research Objective

The specific objective of this research effort is to formally document the DSCC's DMSMS management process and provide suggestions to improve their DMSMS reactive management strategy. In a more general sense, this research will add to the DMSMS body of knowledge. By studying DSCC's DMSMS management processes and formally documenting their strategy, this research provides information that other IMMs can use to make better decisions about their own DMSMS reactive management strategy.

Methodology

This study uses a qualitative research design to answer the research question posed above. The basic characteristics and assumptions of qualitative research are met by this problem. Specifically, qualitative research is descriptive and inductive in nature and it involves fieldwork where the researcher is primarily concerned with the process, interested in personal meaning, and the primary instrument for data collection and analysis (Creswell, 1994:145). A case study is used to study in-depth the DSCC's DMSMS reactive management strategy over a four-month timeframe, September 2001 – December 2001. The data for this case study is collected via observations, interviews, and content analysis of archival material.

Validity and reliability in qualitative research is controversial. Some posit that qualitative researchers have no single stance or consensus concerning validity and reliability (Leedy and Ormrod, 2001:157). In this research effort, internal validity is sought among the data gathered through convergence. Additional strategies such as extensive time in the field and respondent validation are used to support the internal validity of this research effort (Leedy and Ormrod, 2001:106). External validity is somewhat more problematic. The nature of the case study limits the generalizability of this thesis, threatening external validity. No special technique exists for assessing external validity of quantitative research, which means that qualitative research is at no disadvantage (Dooley, 2001:261). Exact replication of the results in other settings may not be possible, but every effort is made to describe the researcher's knowledge of the subject, the research assumptions, and how and why the DSCC was chosen.

Scope and Limitations

DMSMS data was gathered on items managed by the Defense Logistics Agency (DLA), specifically the Defense Support Center Columbus (DSCC). The DSCC manages more than 1.74 million national stock numbers (NSNs) and has annual sales in excess of $1.8 billion. DSCC managed items affect nearly every fielded DoD weapon system. The chief limitation of this thesis is that it does not include items for new production weapon systems or next higher assemblies (NHA). Those items are managed and funded by one of the services or the affected System Program Office (SPO); however, it is hoped that the results of this study could add significantly to the their understanding of their own DMSMS reactive management strategy. Because this effort is focused on the main problem class of DMSMS, electronic items, inference to other materiel categories may not be appropriate.

Relevance

This topic applies to the current efforts of the DoD to minimize the DMSMS effects on aging systems, which have become aggravated due to dwindling military budgets, decreased microelectronic market share, and high operations tempo. As item managers attempt to solve rapidly growing DMSMS problems, many of their decisions are made using fragmented data (DLA, 2001). Last year the DSCC DMSMS Office received discontinuance notices for over 13,000 part numbers, which resulted in the creation of 119 DMSMS case files.

Summary

This chapter discussed the background, the problem, the research questions, the research objective, the methodology, the scope and limitations, and the relevance of this thesis document. The remaining 4 chapters of this thesis include the Literature Review, Methodology, Findings and Analysis, and Conclusions.

The literature review provides an overview of why military items are highly susceptible to DMSMS and why electronic components present such a unique problem. Also, this chapter presents a current description of DMSMS Responsibilities, DMSMS Resolution Alternatives, DoD and Service DMSMS initiatives, and civilian work in the area of DMSMS. This information is used to resolve key issues, refine the scope of the research, and lay the groundwork for the thesis methodology.

The methodology chapter begins by describing the process of conducting a qualitative case study. Justification is provided for using a case study to document the current strategy. Then a complete description of the research methodology for this thesis is described, to include how data were collected, analyzed, and the process mapping tools that were used to create the final product. The chapter ends with a discussion of validity and reliability.

The findings and analysis chapter answers the overall research question by answering the sub-questions posed in Chapter 1. The research methodology established in Chapter 3 was employed to ascertain the answers to these sub-questions and investigative questions where applicable. The data are presented according to the three data collection techniques; interviews, observations, and content analysis of written material. Then each sub-question is restated and answered using the data gathered.

The conclusions and recommendations chapter presents the findings from this research effort. Particularly, what the findings were, their significance, and their implications. Recommendations for action are presented based on these findings. Recommendations for future research into the DMSMS phenomenon conclude the chapter.

II. Literature Review

Chapter Overview

The purpose of this chapter is to provide a thorough review of literature relevant to this research effort. Initially, this chapter provides an overview of why military items are highly susceptible to DMSMS and why electronic components present such a problem. Additionally, this chapter presents a current description of DMSMS responsibilities, DoD and Service DMSMS initiatives, civilian work in the area of DMSMS, AFIT DMSMS research, and DMSMS management strategies. The data gleaned from the literature review will be used to resolve key issues, further refine the scope, and begin to establish the methodology of this research. This chapter introduces and defines the concepts of parts obsolescence, aging weapon systems, and Moore's law. In addition, this chapter reviews currently accepted means for identifying and correcting for DMSMS.

Military and Electronic Environment

Before presenting how the DoD manages DMSMS, it is necessary to explain why the U.S. Military, especially in the area of electronics, is highly susceptible to DMSMS (sometimes called parts obsolescence). There are three main reasons for the electronic DMSMS problem within the DoD: long acquisition lead times and extended life cycles, decreasing market share, and the commercial profit motive.

The U. S. Government is a unique consumer of electronic components. As Figure 1 illustrates, government requirements begin as the commercial market demand is reaching maturity and end well beyond the commercial market's 4-7 year life cycle,

which can exceed 25 years. Current life cycle extensions include the Army's UH-1 to over 44 years, the Navy's F-14 to over 41 years, and the Air Force's B-52 to over 94 years.

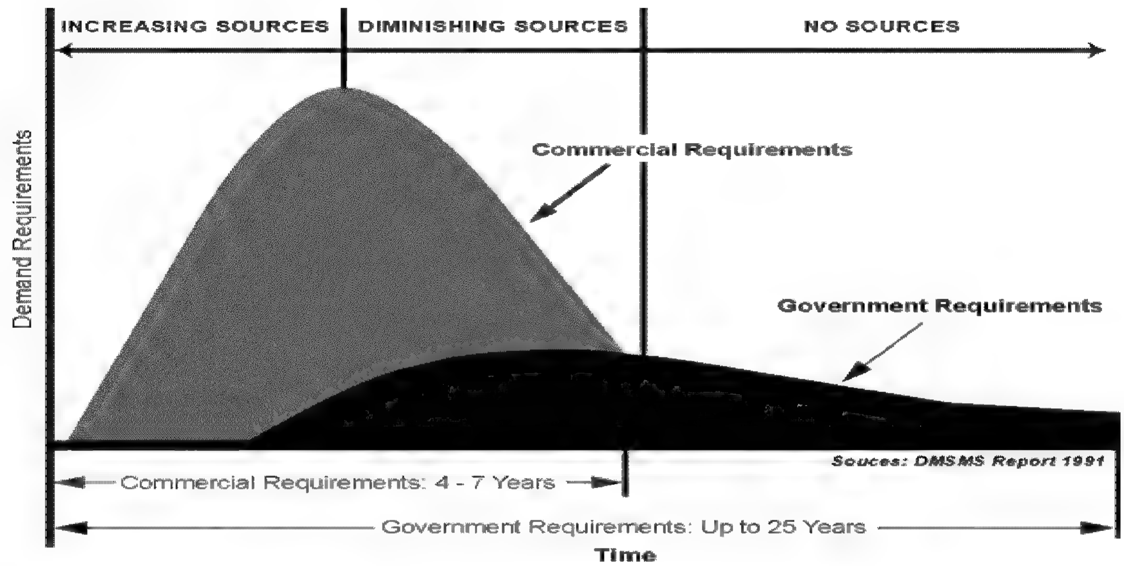


Figure 1. Government versus Commercial Requirements (DMEA, 2001)

As represented in Figure 2, the military's percentage of the microelectronics market in 1975 was 17%. The consumer demand for electronics such as cellular telephones, home computers, and other electronic devices has dwarfed military requirements for microelectronics. By 1995, the total military percentage of the microelectronics market represented less than 1% and is projected to further decline. One organization that reports the customers of electronics is the Semiconductor Industry Association (SIA). According to one DSCC engineer, they will no longer report the U. S. Government separately as an electronics consumer (Beckstedt, 2001).

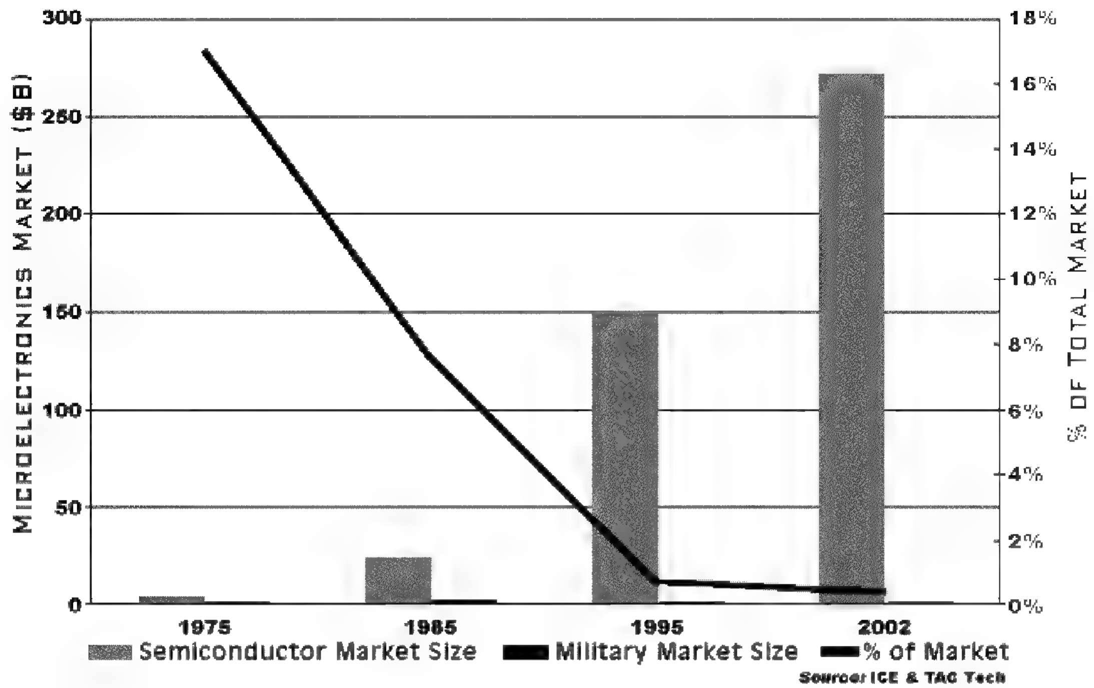


Figure 2. DoD Market Share Erosion (DMEA, 2001)

The single most important factor in DMSMS is the commercial profit motive. Companies focus their efforts on producing items that are profitable. To understand their motive an explanation of Moore's Law is necessary. Moore's Law states that "circuit density or capacity of semiconductors doubles every eighteen months or quadruples every three years" (Schaller, 2001). The mathematical formulation is:

$$(\text{Circuits per chip}) = 2^{(\text{year}-1975)/1.5} \qquad (1)$$

With technology changing so rapidly, and more than 99% of the market representing commercial demand, there is little, if any, incentive for manufactures to dedicate resources to the production of microcircuits primarily used by the military. It is logical to assume that the rapid changes in technology will increase the obsolescence of parts

(DMSMS). Older electronic components, while they are still functional, utilize older technology making them prime candidates for discontinuance (DMEA, 2001).

DMSMS Responsibilities

DoD guidance 4140.1-R states that the Deputy Under Secretary of Defense for Logistics (DUSD (L)) shall exercise authority for direction and management of the DMSMS program, to include the establishment and maintenance of implementing regulations (DoD, 2001a). It also states that each DoD component will designate a focal point for DMSMS issues. The Army assigned overall management of the DMSMS program to the Deputy Chief of Staff (DCS) for Research, Development, and Acquisition (AMCRAD). The Navy assigned DMSMS management responsibility to the Naval Sea Systems Command (NAVSEA). Air Force DMSMS responsibilities have been assumed by the Air Force Materiel Command (AFMC). Specifically, the Air Force DMSMS program is managed by the Air Force Research Laboratory (AFRL) Manufacturing Technologies Division.

Commanders of activities with responsibility for design control, acquisition, and management of any centrally managed item used within a weapon system or equivalent shall implement a DMSMS program (DoD, 2001a). The DSCC is one such activity. Responsibility for managing DMSMS had been pushed down to individual managers. As of one year ago, the DSCC DMSMS program is once again centrally located and managed (Robinson, 2001).

The Defense Microelectronics Agency (DMEA) has been designated by the DUSD (L) as the Executive Agent for DoD microelectronics DMSMS. As such, DMEA is a key player in the development and coordination of solutions to the DoD's obsolescence problems and is responsible for issues relating to integrated circuit microelectronics DMSMS (DMEA, 2001). Their responsibilities cut across the full spectrum of advanced microcircuit technology and DMSMS issues.

Funding for parts is the responsibility of the Program Manager, DLA, or the country. Table 1 below delineates the funding responsibilities based on the type of part. Spare or repair parts for fielded weapon systems are funded up-front by the DLA activity. This funding system provides little incentive for services to provide accurate estimates of item demand. Because services are not penalized for over-estimations, they are incentivized to over-estimate requirements. Further, because the DLA has the overwhelming responsibility to provide the part, regardless if the service forecasts demand or not, there is little incentive to forecast accurately at all (Beckstedt, 2001).

Table 1. Parts Funding Responsibilities

Type of Part(s)	Agency Responsible for Funding Part(s)
Parts for a new production of weapon systems	Program Manager
Next higher assemblies (NHA)	Program Manager
Spare and Repair Parts	DLA purchases "up-front" and sells to DoD activities (e.g., NHA managers)
Foreign Military Sales (FMS)	Country

DoD and Service DMSMS Initiatives

Because of the increasing challenges faced by the DoD in procuring military grade components, and the impact those challenges have on both new system procurement and spare part procurement for fielded systems, the DoD developed the Diminishing Manufacturing Sources / Materiel Shortages mission (GIDEP, 2001). Numerous initiatives at both the DoD and service level have been implemented to combat DMSMS. A partial list of the programs that have been implemented to identify, track, and help manage this growing problem is provided below.

Government Industry Data Exchange Program (GIDEP). Chartered by the Joint Logistics Commanders as a cooperative activity between government and industry, GIDEP is responsible for maintaining a centralized database for managing and disseminating DMSMS information. GIDEP is funded and managed by the U.S. Government. The program provides a media for the exchange of technical information essential during research, design, development, production and operational phases of the life cycle of systems, facilities and equipment (GIDEP, 2001). GIDEP participants include:

> US Army, Navy, Air Force, Defense Logistics Agency, National Aeronautical and Space Administration, Department of Energy, Department of Labor, Department of Commerce, General Services Administration, Federal Aviation Administration, US Postal Service, National Institute of Standards and Technology, National Security Agency, Canadian Department of Defence, and hundreds of industrial organizations producing parts, components and equipment for the government which participate in the program. (GIDEP, 2001)

GIDEP is working to enhance its role in DMSMS management by incorporating the DMS Shared Data Warehouse, the DMSMS Prediction Tool, and the Army DMSMS Information System into the GIDEP system.

Shared Data Warehouse (SDW). To manage the problems created by DMSMS more effectively, the DLA developed the Shared Data Warehouse (SDW). The SDW is a web-enabled database application that provides seamless connectivity to various disparate technical databases resident at the DSCC and other sources such as the Federal Logistics Information System (FLIS). The objective of the SDW is to enhance and improve the sustainability of DoD weapon systems by reducing the impact of DMSMS on affected weapon systems. This is sought by applying business process evaluation practices that augment existing DMSMS screening processes (ECRC, 2001). SDW is on-line and accessible through the DSCC website; however, there are many problems with the integrity of the data contained within the database (Shkane, 2001a).

Teaming Group Initiative. Established by the Office of the Undersecretary of Defense for Logistics (OUSD-L), the DMSMS Teaming Group is a group of representatives from various DoD programs and industry that work together to share solutions to common component obsolescence problems (GIDEP, 2001). The group maintains a database of DMSMS information and work to find common solutions to obsolescence problems. Team members communicate every other week via telephone conference and meet quarterly.

Type Designation Automated System (TDAS). The TDAS is an interface between weapon system managers and the Federal Logistics Information System (FLIS). During the acquisition phase, managers must conduct research to identify if an item or

technology is currently stocked. TDAS provides an accurate data source on like systems and components already in the government inventory thereby avoiding their repurchase (GIDEP, 2001).

Virtual Parts Supply Base (VPSB). The VPSB was developed by DMEA to improve the sustainability of DoD weapon systems through an integrated data environment (GIDEP, 2001). To facilitate the move toward reduced inventory and infrastructure, the VPSB uses the internet and telecommunications to obtain parts rapidly and economically for all types of weapon systems.

Rapid Retargeting. Rapid Retargeting is a design process that uses a collection of sophisticated analysis, simulation, and modeling tools to transform an existing electronic module from a fielded system to a target module with the same form, fit, and function (GIDEP, 2001). Rapid Retargeting uses a hardware descriptive language to capture the hardware's functionality. Software models are developed and tested against the original for verification. The use of these simulated software models reduces design cycle time and reduces program risk.

Obsolescence Prediction Tool (OPT). The OPT was developed by the Naval Supply Systems Command. It is an application designed to provide an automated process to monitor obsolescence within weapon systems via parts status and technology trend forecasts (GIDEP, 2001). The software application uses artificial intelligence to categorize part descriptions into groupings and then performs obsolescence evaluations. Through automation, OPT provides proactive notification, consistent predictions, individual program assessments, and larger evaluations conducted more frequently.

Virtual System Implementation Plan (VSIP). The VSIP initiative is managed by the Naval Supply Systems Command and includes two major elements, the Virtual Prototyping System and the Virtual Engineering System.

The Virtual Prototyping System (VPS) provides modeling, simulation, design conversion methods, and tools that automate the prototype development process for electronic designs and complex systems (GIDEP, 2001). VPS will develop an automated process to capture the functionality of legacy designs using Very High Speed Integrated Circuit Hardware Descriptive Language (VHDL), which is described later. VPS will be capable of accepting various hardware design specifications and drawings, schematics, Computer Aided Design (CAD) files and the creation and use of empirical data from a well-defined and documented test process (GIDEP, 2001).

The Virtual Engineering System (VES) is composed primarily of the Virtual Design Repository (VDR), the Virtual Engineering Network (VEN) and the Virtual Engineering Workstation (VEW). The VDR represents the database and file server for the entire network of Navy laboratories and authorized industry users. The VDR will employ state-of-the-art NDI/COTS equipment for rapid retrieval of VHDL and other software based models by remote users (GIDEP, 2001).

Compatible Processor Upgrade Program (CPUP). The Naval Supply Systems Command, through a Small Business Innovation Research (SBIR) program, developed the CPUP to provide a solution to computer processor obsolescence. Using publicly available information, processors are designed and engineered. The development methodology is applied to data processors, signal processors, and controllers, and consists

of four phases: architecture, detailed design, prototype, and debug and validation (GIDEP, 2001).

Rapid Response to Critical System Requirements (R2CSR). The R2CSR is a 6-year, government-wide contract that was coordinated by the Army Communication – Electronics Command. The contract provides multiple prime contractors and subcontractors for quick and less costly DMSMS solutions, which may include engineering services, acquisition from vendors, manufacture, integration, installation, and studies (GIDEP, 2001).

Modernization Through Spares (MTS). MTS is a Department of the Army (DA) program that was developed by the Army Materiel Command. The MTS strategy is to insert new technology and use commercial products to reduce sustainment costs and extend system's useful life. This acquisition strategy assists program managers who develop weapon systems and item managers who buy spares for fielded weapon systems. MTS makes it possible to use Operations and Maintenance (O & M) funds to redesign an obsolete part that will produce one or more of the following: increased performance, expanded capacity, lower cost, new design (AMC, 1999:G-6).

Radiation Tolerance Assured Supply and Support Center (RTASSC). The RTASSC program was developed by the White Sands Missile Range's Directorate for Applied Technology, Test and Simulation. It assists military and space programs in procuring discrete semiconductors and integrated circuits that are classified hardened critical items (HCIs), assembled hardware and particularly hard-to-find discontinued or obsolete HCIs (GIDEP, 2001). Through Letters of Agreement and Inter-Service Support

Agreements, the RTASSC establishes partnerships between the government, vendors, and manufacturers.

Affordable Sustainment of Army Systems. The Affordable Sustainment of Army Systems Program develops and demonstrates an automated reverse engineering system that will nondestructively extract the information necessary to remanufacture multi-layer printed wiring assemblies (GIDEP, 2001). This system generates technical data packages from the extracted board layout information. Reportedly, this program will reduce costs and cycle time by up to 90% (Monteleone, 2001).

Plastic Encapsulated Microcircuit (PEM). The PEM initiative is being developed by the Manufacturing Technologies Division, U. S. Army Aviation and Missile Command. Its objective is to enhance, demonstrate, and implement standardized processes for a coating system for integrated circuits at the wafer level to provide near hermetic capabilities regardless of the packaging approach used (GIDEP, 2001). Initial results indicate up to a 10% increase in yield and a 90% cost savings through the use of PEMs.

Army DMSMS Information System. The Army DMSMS Information System is an integration of the data contained in developmental and existing systems. The data will be pushed to the appropriate sources for fast, reliable, and accountable identification and notification of DMSMS items (GIDEP, 2001). Also, this information system will be available via the internet to authorized users.

Parts Obsolescence Initiative (BAA-98-14-MLKT). The Parts Obsolescence Initiative, which is also referred to as the "BAA," is sponsored by the Manufacturing Technology Division of the Air Force Research Lab (AFRL). Based on its objective of

developing new process applications, tools, and pilot programs to help the government better manage electronic component obsolescence, the BAA should determine how to develop relationships with integrated circuit manufacturers, how to handle parts obsolescence and availability, and how to improve life prediction of parts (GIDEP, 2001). Its first purpose is the Application of Commercially Manufactured Electronics (ACME), which addresses packaging, assembly, improved power sources, and other approaches required to reliably use commercial components in military systems. Pilot programs developed by the BAA should improve corporate level policies and procedures, cost effectiveness of parts obsolescence management tools, and effectiveness of technology efforts developed in ACME (GIDEP, 2001).

Viable Combat Avionics (VCA). VCA (a.k.a. Affordable Combat Avionics) was developed in response to the October 1998 Quarterly Acquisition Program Review (QAPR) at the direction of the Chief of Staff of the Air Force (CSAF), General Ryan. The VCA program is managed by the Air Forces newest System Program Office (SPO), the Aging Aircraft SPO. VCA's objective is to minimize the impact of obsolescence on avionics systems through a focus on total ownership costs (TOC), evolutionary acquisition, and open systems.

Electronic Parts Obsolescence Initiative (EPOI). The EPOI is a five-year, $32 million Air Force ManTech program that is managed by the AFRL (Poelking, 2001b). EPOI's objective is to develop a systematic approach to managing obsolescence that will ensure Air Force mission readiness and affordably increase the useful life of aging Air Force weapon systems. EPOI is developing management and re-engineering tools for

defense systems affected by parts obsolescence and reliability models for commercially manufactured electronics used in defense systems.

Civilian Work in the Area of DMSMS

As with many large projects within the DoD, the civilian industry provides invaluable assistance to the government in the management of DMSMS. Three of the more prominent civilian companies assisting the DoD in its war against obsolescence are listed below. A complete list of civilian companies working in the area of DMSMS and obsolescence would be well outside the scope of this research effort.

Manufacturing Technologies, Inc. (MTI). Established in 1984, MTI has engaged in the manufacture of sophisticated electronic products. MTI capabilities include design engineering, manufacturing, technical services, and obsolescence management (MTI, 2001). The primary obsolescence tools that MTI provides to the U. S. military are called the AVCOM, ARMCOM, and NAVCOM. According to the company literature, the three systems are identical applications providing data for specific weapon systems to address DMSMS; however, there are a few minor label changes within the three applications (MTI, 2001). The chief advantage of these applications is their ability to focus on the specific part within a specific system. Specifically these systems provide: component data; form, fit, function alternatives; impact analysis; obsolescence projections; decision-making tools; management link between systems; tracking of discontinued inventories and after market suppliers; alerts; real-time updates; and locating services for obsolete parts.

PartMiner Free Trade Zone. According to their home page, the PartMiner Free Trade Zone provides a broad range of extremely valuable services for the selection, location, negotiation and acquisition of electronic components (PartMiner, 2001). PartMiner is frequently used by the engineers at DSCC to locate alternate sources or find a substitute item for a part that has been identified as discontinued (Besore, 2001a). PartMiner provides its many customers with design resources and data sheets that allow for a direct comparison of two items. PartMiner is primarily used as a research tool by DSCC, but it can also facilitate and streamline sourcing and procurement activities. Buyers can use the PartMiner Free Trade Zone to conduct part research, determine market prices and product availability, obtain quotes, and buy electronic components (PartMiner, 2001). PartMiner Free Trade Zone provides a direct link to PartMiner Direct. PartMiner Direct is a primary source of electronic components offering competitive pricing on components in stock in its ISO 9002 certified warehouse facility, as well as purchasing services for scheduled (just-in-time) deliveries, vendor consolidation, and bill of materials fulfillment (PartMiner, 2001). It can also facilitate the search for items identified as DMSMS by tapping over 6,000 suppliers all over the globe.

Transition Analysis of Component Technology (TACTech). TACTech is an interactive data service that provides internally developed software and library content through a client/server format to over 120 companies world-wide (TACTech, 2001). Founded in 1987, TACTech responded to the growing need among manufacturers to address electronic, specifically semiconductor, obsolescence brought about by rapidly changing technology. TACTech's list of clients includes the Federal Aviation Administration (FAA), Lockheed Martin, Boeing Company, Raytheon, General Electric,

and every branch of the U. S. military. TACTech's utilization as a design and component selection tool maximizes component procurability from the design stage through production and post-production (TACTech, 2001).

AFIT Research of DMSMS

The area of DMSMS has been a subject of many Air Force Institute of Technology (AFIT) theses. Captain Brooks' thesis and First Lieutenant Gravier's thesis pertained to predicting DMSMS. Captains David Capotosti's and Eugene M. Curran's thesis and Captain Bell's thesis studied the effects of DMSMS on specific weapon systems, the AN/ASQ-38 Radar System and the AN/APG-63/70 Radar System respectively. Christine Fisher's and Walter Sheehan's theses and James Brown's thesis studied Life-of-Type (LOT) buy decisions. A brief synopsis of each thesis effort follows.

Predicting DMSMS. In 1981, then Captain Michael E. Brooks completed a thesis entitled *An Investigation of Time Series Growth Curves as a Predictor of Diminishing Manufacturing Sources of Electronic Components*. Captain Brooks' research objectives were twofold.

1. To determine using aggregate annual commercial sales data can satisfactorily explain the life cycle growth of certain families of obsolete electronic components. An attempt will be made to see if the data sets form "S-shaped" growth curves as described in the technological forecasting literature, and then to find mathematical equations that best explain the actual curves.

2. To determine the feasibilility of using the S-curve as a predictor of DMS, provided the data sets for the obsolete components form S-curves. The curves will be examined to see where DMS occurred in the life cycle growth of the obsolete component. (Brooks, 1981:16-17)

His research methodology included trend extrapolation, which is a technological forecasting technique. He used the sales data for three technologies of obsolete electronic components as the dependent variable and time as the independent variable to conclude that these components followed predictable growth patterns that can be described by an S-curve (Brooks, 1981:67). He found that the Pearl function, a common formula for producing an S-curve, provided the best overall fit for the data. The Pearl function, also know as Pear-Reed formula of the logistics curve, is expressed in general terms as:

$$y = 1/a+bc^{t} \tag{2}$$

where a, b, and c are shape parameters and t is equal to time.

Although he stated that no substantial conclusions could be drawn from the research question, he did conclude that DMS occurred at or near the growth curve saturation level. The saturation level is the point of the growth curve where the product has reached its growth potential limit.

In his 1999 thesis entitled *Logistics Regression Modeling of Diminishing Manufacturing Sources for Integrated Circuits*, First Lieutenant Gravier used a logistics regression model to relate parts characteristics to DMSMS presence. Just as Captain Brooks had attempted to determine the feasibility of predicting DMSMS based upon an item's position on its growth curve, Lieutenant Gravier attempted to determine the feasibility of predicting DMSMS based upon an item's characteristics.

Five item characteristics were evaluated: design age, military specificity, function, technology, and voltage. He concluded that design age with a coefficient of multiple determination (R^2) of .0599 and military specificity with an R^2 of .0578 were strong predictors of DMSMS presence. However, in nonlinear and multiple regression

analysis a model with a high value for the coefficient of multiple determination (an R^2 that approaches 1) is considered successful in explaining the variation of the dependent variable (Devore, 2000:506,566). Nonetheless, Lieutenant Gravier stated that when properly applied these logistics models can identify high-risk electronic components (Gravier, 1999:91).

While neither research effort irrefutably establish a method for predicting DMSMS, each provided an understanding of the effects of item characteristics on the level of DMSMS.

Effects of DMSMS on Specific Weapon Systems. In 1981, then Captains David Capotosti and Eugene M. Curran completed a thesis entitled *A Study on the Effects of Diminishing Manufacturing Sources on the Supportability of the AN/ASQ-38 Radar System*. Their research questions were:

1. What are the specific DMS related factors which contributed to the Air Force's inability to provide the necessary support for the AN/ASQ-38 radar system?

2. What generalizations can be made concerning the applicability of the AN/ASQ-38 DMS factors to major aircraft systems of the future?

3. What methods can be developed which would aid logistics managers in eliminating or minimizing the effects of DMS? (Capotosti and Curran, 1981:12)

Captain Capotosti and Captain Curran conducted interviews to gather the perceptions of the civilian industry regarding DMS. They concluded that the DMS contributing factors were: technical, functional, financial, and economic. Further, they concluded that these same factors could be found in other weapon systems as well (Capotosti and Curran, 1981:74). Their list of methods to lessen the impact of DMS

included several acquisition reform initiatives that have been implemented or proposed within the last decade. Specifically they listed seven suggestions.

1. Improve DoD long-range forecasting
2. Increase use of multi-year procurement techniques in spares acquisition
3. Increase use of standardization in acquisition of systems
4. Greater emphasis on performance specifications
5. Shorten weapon system acquisition process
6. Increase DoD responsiveness to technological change
7. Increase DoD-industry communication on subject of DMS (Capotosti and Curran, 1981:74)

In his 1998 thesis entitled *Tracking and Correcting for Diminishing Manufacturing Sources and Obsolescence in a Mature Fighter Aircraft: A Study of the F-15 AN/APG-63/70 Radar System*, Captain Bell's aim was to achieve a deeper understanding of obsolescence and DMSMS needed to effectively address specific inventory problems (Bell, 1998:6). His overall research question was: "How should the U. S. Air Force confront the occurrence of obsolescence and DMSMS in the F-15 radar system?" (Bell, 1998:7). His additional research questions fit into three categories: quantity and location of DMSMS in the radar system, tools and techniques used to combat obsolescence, and the utility of AVCOM. Data on the radar system was taken from the AVCOM system. AVCOM's stoplight rating of items indicates a particular item's level of DMSMS. Green indicates two or more manufacturers exist for the item, yellow indicates that there is only one manufacturer for the item, and red indicates that

there is no known manufacturer for the item. He found that a single item going obsolete could affect many components within the system (e.g., Line Replaceable Units (LRUs) and Shop Replaceable Units (SRUs)). Therefore, for managers to understand the impact of items going obsolete they must know where that item appears in the system.

Captain Bell's recommendations were so well received by the AFMC DMSMS office that they were referenced in the DMSMS *Case Resolution Guide* (version 2.0). The specific recommendations were:

1. Update AVCOM to include a Pareto analysis tool
2. Closer monitoring of items that are flagged yellow in AVCOM
3. Better AVCOM prediction capability
4. Other programs implement the techniques successfully being used by the F-15 Office
5. Implement a proactive tracking system as early as possible
6. Eliminate duplication of effort by creating a shared data warehouse. (Bell, 1998: 70-71)

Both of these AFIT theses appear to have been well received by the acquisition and DMSMS management communities. Many of Captain Capotosti's and Captain Curran's recommendations are listed among the current acquisition reform initiatives. As mentioned above, Captain Bell's recommendations were included in Air Force DMSMS guidance.

Life-of-Type (LOT) Buy Decisions. In 1982, Christine Fisher and Walter Sheehan completed a thesis entitled *The Life-of-Type Inventory Decision for Diminishing Manufacturing Sources Items: A Sensitivity Study*. Their research questions were:

1. Do forecasting methods and inventory models exist which may be applied to the DMS LOT buy situation?

2. What is DESC's current LOT buy quantity decision "model" and what are its assumptions?

3. Where does the model lead in terms of support and cost? (How effective is it?)

4. What is the nature of demand of DMS electronic components? What are the behavior and characteristics of "typical" DMS electronic items?

5. How do the costs, implicit and explicit, which play in the LOT buy decision trade off with LOT buy quantities needed for support?

6. How can the understanding of the behavior and characteristics of "typical" DMS items and the cost sensitivities be used to improve the efficiency and effectiveness of the LOT buy decision? (Fisher and Sheehan, 1982:10)

Their research methodology included content analysis of the current literature, personal interviews, and a review of DESC's (now DSCC) 1981 case files. The case file data were used to test model assumptions in FORTRAN and the Statistical Package for the Social Sciences (SPSS) programs. Their chief concern was how DESC computed LOT buy quantities. At that time, they assumed demand to be constant over time and computed LOT buy quantities based on the previous two years. Although their simple linear regression model could not refute the assumption of constant mean demand over time, they recommended a more systematic LOT buy approach that takes into account item characteristics.

In 1990, Mr. James L. Brown completed a thesis entitled *Diminished Manufacturing Source: A Common Sense Approach to Requirements Determination for Life-of-Type Procurement*. Using a sample from thirteen years of LOT buy data, he

concluded that the LOT buy policy resulted in over procurement 79% of the time and under procurement 12% of the time. Because of the high percentage of over procurements, Mr. Brown evaluated the implications of reducing the LOT buys by 10%, 33%, and 50%. He concluded that a 33% LOT buy quantity reduction resulted in an acceptable 6.4% decline in support (Brown, 1990:80).

Although their research has been overcome by the LOT buy changes imposed by Congress in 1998 (discussed in detail later in this chapter), Christine Fisher's and Walter Sheehan's thesis and James L. Brown's thesis provide insight into how LOT buy quantities had been determined and the trade-offs that did exist between support and percentage reduction in the LOT buy quantity.

DMSMS Mitigation Strategies

DMSMS mitigation strategies can be generally considered proactive or reactive in nature. The two may not be mutually exclusive, and may be used in concert to correct a current DMSMS issue while simultaneously planning for future obsolescence issues.

Proactive Strategies. Proactive strategies address DMSMS issues early during system development and are the responsibility of the SPO. Program managers must balance the risk of obsolescence with the need to remain on schedule, within budget, and provide the capabilities requested in the Operational Requirements Document (ORD). The three proactive strategies listed below represent the highest level of agency involvement.

Open Systems Architecture. The use of open system architecture for weapon system electronics acquisition was mandated by the Undersecretary of Defense for

Acquisition and Technology (USD (A&T)) on 29 November 1994. Changes to DoD 5000.2-R in 1996 and 1998 further defined the mandate to include a definition of an open systems strategy. As defined by DoD 5000.2-R:

> An open systems strategy focuses on fielding superior warfighting capability more quickly and more affordably by using multiple suppliers, and commercially supported practices, products, specifications, and standards selected based on performance, cost, industry acceptance, long term availability and supportability, and upgrade potential.
> (DoD, 1998b: 32-33)

Additionally, an open system is completely defined, available to the public, and has an architecture that is consensus-based. A system that is widely accepted in the market and has a public standard base will have many suppliers, many customers, and long life architecture with the ability to do technology upgrades (OSJTF, 2000).

The claimed benefits of open system architecture are increased inter-operability, decreased life cycle cost, and increased competitiveness. As with any management strategy there are trade-offs. The use of open systems places the DoD in the role of consumer rather than producer, which gives the DoD less control over the product. Also, because the system is manufactured by and for a commercial market, it may not be the optimum design for military applications.

Pre-planned Product Improvements (P^3I). Pre-planned product improvements (also known as periodic replacement, technology insertion, and technology refresh) is a strategy of replacing system electronics every few years. The chief drawback to this strategy is its high cost, but this cost may be offset by increased system performance and the avoidance of future obsolescence management issues (AMC, 2001:41).

Very High Speed Integrated Circuit Hardware Description Language. Commonly referred to as VHDL, Very High Speed Integrated Circuit Hardware Description Language is a computer programming language used to design, model, and simulate digital computing hardware that was originally sponsored by the Office of the Secretary of Defense (OSD) in the 1980's. The language development was led by the Air Force Research Lab (AFRL) and has been referred to as "DoD's gift to the electronics industry" (Barker, 2001). VHDL makes the redesign of printed wiring assemblies and custom circuits easier. VHDL has been used by the F-22 SPO to re-design the Application Specific Integrated Circuit (ASIC) at about half the cost, the F-16 SPO to re-engineer a board with a cost avoidance of $150,000, and the E-3 SPO to consolidate wiring boards with a cost avoidance of $3.25 million (Baker, 2001). VHDL shortens a project's design cycle, avoids costs, and helps meet the systems requirements; unfortunately, when faced with the possibility of budget overruns many program managers cut the VDHL funding first (Poelking, 2001a).

Reactive Strategies. Many resolution alternatives exist that can be used individually or in concert to respond reactively to DMSMS occurrences. DoD Regulation 4140.1-R requires each component's focal point and Integrated Materiel Managers (IMM) to implement the most cost-effective solution consistent with mission requirements when an item is identified as DMSMS (DoD, 1998a). Table 2 lists the fourteen DoD DMSMS resolution alternatives in order of preference along with the comparable service resolution alternatives.

Encourage Existing Source. Encouraging the existing source to continue production is the preferred method of resolving a DMSMS issue. In the main, there are two types of encouragement: price incentives and quantity guarantees.

Table 2. Reactive Strategies

<table>
<tr><th>DoD</th><th>US Army</th><th>US Navy</th><th>US Air Force</th></tr>
<tr><th>DoD 4140.1-R</th><th>AMC-P5-23</th><th>Cast Resolution Procedures Guide</th><th>Case Resolution Guide (version 2.0)</th></tr>
<tr><td>Existing Source</td><td></td><td></td><td>Existing Source</td></tr>
<tr><td>Find Another Source</td><td>Another Source</td><td>Aftermarket Mfg.</td><td>Alternate Source</td></tr>
<tr><td>Substitute</td><td>Existing Substitute</td><td></td><td></td></tr>
<tr><td>Limited Substitute</td><td></td><td>Substitution</td><td>Substitution</td></tr>
<tr><td>Redefine MIL-SPEC</td><td>Redefine Military Requirement</td><td></td><td>Redefine Requirement to Accept COTS</td></tr>
<tr><td>Emulate</td><td>Emulation</td><td>Emulation</td><td>Emulation</td></tr>
<tr><td>Bridge Buy</td><td>Bridge Buy</td><td></td><td rowspan="2">Life-of-Type / Bridge Buy</td></tr>
<tr><td>Life-of-Type Buy</td><td>Life-of-Type Buy</td><td>Life-of-Type Buy</td></tr>
<tr><td>New Prime w/ GFE</td><td></td><td>Develop New Source</td><td>Develop New Source</td></tr>
<tr><td>Reclamation</td><td></td><td>Reclamation</td><td>Reclamation</td></tr>
<tr><td>Modify/Redesign</td><td>Modification/Redesign</td><td>Redesign</td><td>Redesign</td></tr>
<tr><td>Replace System</td><td>System Replacement</td><td></td><td>Replacement</td></tr>
<tr><td>Contractual Agreement</td><td>Contractor Requirement</td><td></td><td>Contractor Maintained Inventory</td></tr>
<tr><td>Production Warranty</td><td></td><td></td><td>Production Warranty</td></tr>
<tr><td></td><td></td><td>Reverse Engineering</td><td>Reverse Engineering</td></tr>
</table>

Find Another Source. One company may be willing to produce a product that is not profitable for another company. When considering the use of another source, also called an aftermarket manufacturer, the analyst must ensure that the company has the capability to meet the original item specification requirements (AFMC, 2001:56). Although its use is not mandated by DSCC, the Qualified Manufacturers List (QML) may offer the best solution. The QML is a listing of facilities that have been evaluated and determined to be acceptable based on the testing and approval of a sample specimen and conformance to the applicable [product] specification. A replacement item selected from a vendor on the QML may be acceptable as-is and require no further testing.

Substitute. Substitution involves finding a similar item that meets the Form, Fit, Function, and Interface (F^3I) of the DMSMS item. DoD 4140.1-R and Army guidance, unlike that of the Navy and Air Force, differentiate between a substitute, an item that fully meets the design requirements of the original item, and a limited substitute, which is described next.

Limited Substitute. A limited substitute is an item that does not fully meet the form, fit, and function of the DMSMS item. The definition of a substitute item referred to in the AFMC *Case Resolution Guide* and the NAVSEA *Case Resolution Procedures Guide*, "a similar part with an acceptable degree of non-conformance", fits closely with the definition of limited substitute (AFMC, 2001:59; NAVSEA, 2001:35).

Redefine Military Specifications. Redefine a military specification (MIL-SPEC) item through the respective Engineering Support Activity (ESA) and consider buying a replacement item from a commercial source (DoD, 1998a). This is commonly referred to as selecting a Commercial-Off-The-Shelf (COTS) item.

Produce a Substitute Item (Form, Fit, Function). Use current manufacturing processes to produce a substitute item with the same form, fit, and function of the DMSMS item (DoD, 1998). This is commonly referred to as emulation and is quite useful in the area of microcircuits. The Generalized Emulation of Microcircuits (GEM) program is managed by DSCC and the current contractor is Sarnoff Corporation. Sarnoff has developed a versatile system that can emulate RTL, DTL, TTL, ECL, PMOS, and CMOS components (DSCC, 2001). The flexible foundry provided by Sarnoff costs DLA $2 million annually, which is amortized over the entire population of DLA items (Beckstedt, 2001). The minimum order quantity through the GEM program is 50 microcircuits. Since the beginning of production in 1997, GEM has produced 35,000 microcircuits (Beckstedt, 2001).

Bridge Buy. A bridge buy is a temporary measure that provides sufficient time to develop one of the other solutions.

Life-of-Type (LOT) Buy. Life-of-Type (LOT) buys are placed using the aggregated demand for an item through the estimated remaining life of the system. Additionally, DoD 4140.1-R states sufficient quantities will be purchased to support later production and procurement requirements. Congress limited LOT buys to a two-year supply, stating "The Secretary of Defense may not incur any obligation against a stock fund of the Department of Defense for the acquisition of any item of supply if that acquisition is likely to result in an on-hand inventory…in excess of two years of operating stock (US Congress, 1998)." This statement was immediately followed by exceptions. These exceptions provide a means for the procuring activity head to exceed the two-year limitation when more than two years of stock but less than three years of

stock is needed to reach an economic order quantity and when the acquisition is needed to maintain the industrial base for reasons of national security.

Change "Prime" Sources if Item Uses GFE. If the prime contractor that has identified the DMSMS item is using government furnished equipment (GFE) to produce the item, use the GFE to establish a new source.

Reclamation. Reclamation is the use of an item or component taken from a component or system that is no longer in service. Potential sources for reclamation include beyond economic repair (BER) equipment at government depot repair facilities, government and/or commercial surplus and stored materiel that has been removed due to modernization programs and items within deactivated or decommissioned units (NAVSEA, 2001:40). Reclamation is considered a short-term resolution alternative that should be used to thwart a DMSMS crisis.

Modify or Redesign the End Item to Replace or Eliminate. This alternative involves the designing out of DMSMS items via engineering changes at various system indenture levels, with the goal of enhancing system performance and improving reliability and maintainability (Livingston, 2000). Technology insertion, which is becoming one of the most common types of redesign, is a F^3I replacement for aging electronics at the component or board level.

Replace System. System replacement may be appropriate when there are large numbers of DMSMS items within a given system. The decision to replace the system would require extensive cost analysis (DoD, 1998).

Require the Using Contractor to Maintain Inventory. Require the using contractor, through contractual agreements, to maintain an inventory of DMSMS items

for future DoD demands (DoD, 1998). This resolution alternative is somewhat similar to a LOT buy; however, this resolution requires the contractor to maintain the inventory. Appropriate trade-off analysis must be performed between the cost of the government carrying the excess inventory and paying the contractual cost of the contractor carrying the excess inventory.

Obtain Production Warranty. A production warranty requires the contractor to supply a given item, regardless of demand, for a specified period. Similar to requiring the contractor to maintain inventory, but the production warranty covers a specified time rather than an inventory level.

Resolution of Key Issues

A thorough review of the literature reinforced the early findings that most DMSMS cases involve electronic components, especially semiconductors and microcircuits. The FSCs hardest hit are 5961 and 5962, which are both primarily managed by DSCC.

While the DMSMS initiatives, proactive and reactive strategies, and civilian tools provide a spectrum of management alternatives for developing systems, IMMs for fielded weapon system spares are limited in their choices. As the IMM for most electronic components, the DSCC must rely almost solely on the reactive management strategies.

Refinement of Scope

Suggested by the list of initiatives and the many offices of responsibility, DMSMS is a large problem for the U. S. military that will continue to grow. This thesis will concentrate on the DMSMS reactive management strategy of DSCC. Because of this

specificity, the applicability of the research findings may not be generalizable to other agencies within the DMSMS community. However, the complete case study of DSCC's DMSMS reactive management strategy may provide a methodology that others can mimic to improve their own DMSMS management strategy.

Methodology Issues

With no prior knowledge of DMSMS, the literature review was the primary means of gaining initial insight into the topic of DMSMS. It consisted of a broad but in-depth search that took many months to accomplish. The importance of the knowledge gained through the literature review cannot be understated. The interpretative nature of qualitative research demands that the researcher's past experience and familiarity with the topic, setting, and participants be expressed so that values, biases, and judgments are made clear to the reader (Creswell, 1994:147).

Although the specific knowledge of the problem came with gaining entry into the DSCC DMSMS Office, the literature review laid the groundwork for a common dialogue, and made possible the interviews and observations of the DMSMS reactive management process. A complete methodology for this research effort follows in the next chapter.

Chapter Summary

This chapter presented a review of the current DMSMS literature. The intent of the literature review was to arrive at an understanding of the current DMSMS environment within the U. S. military, particularly in the area of electronics, and use that understanding to resolve key issues, further refine the scope, and establish a methodology for this research. To that end, DMSMS responsibilities, DoD and Service DMSMS

initiatives, civilian work in the area of DMSMS, AFIT research into DMSMS, and DMSMS management strategies were covered in detail.

III. Methodology

"In a qualitative study, the specific methods that you use will ultimately be constrained only by the limits of your imagination."

- Paul Leedy and Jeanne Ormrod

Chapter Overview

The purpose of this chapter is to provide an explanation of the methodology used to accomplish the research objective. Initially, this chapter provides an overview of the qualitative research paradigm contrasted against a quantitative research paradigm. A justification is given for using a qualitative design for this study, which is accompanied by a discussion of its assumptions and suitability. Then, brief descriptions of the different types of qualitative designs are described. From those, the case study is further described with its disciplines of origin, definition of design, and any special characteristics.

After the theoretical groundwork is laid, an explication of the participants and the relationship between them is detailed followed by the experience and the level of involvement of the researcher. Next, a complete description of the research methodology for this thesis is provided to include how data were collected, how data were analyzed, and what tools were used to create the final product. Lastly, validity and reliability are addressed.

Research Design

In the main, there are two research paradigms, the quantitative research paradigm and the qualitative research paradigm. The quantitative paradigm is based on testing theory, measuring with numbers, and analyzing with statistics in order to determine whether the predictive generalizations of a theory hold true (Creswell, 1994:2). Conversely, the qualitative paradigm is an inquiry process of understanding a problem or process by building a complex, holistic picture by conducting research in the natural setting and expressing the results in narrative form (Creswell, 1994:1). Table 3 below contrasts the two paradigms in detail.

Table 3. Distinguishing Characteristics of Quantitative and Qualitative Approaches (Leedy and Ormrod, 2001:102)

Question	Quantitative	Qualitative
What is the purpose of the research?	• To explain and predict • To confirm and validate • To test theory	• To describe and explain • To explore and interpret • To build theory
What is the nature of the research process?	• Focused • Known variables • Established guidelines • Static design • Context-free • Detached view	• Holistic • Unknown • Flexible guidelines • Emergent design • Context-bound • Personal view
What are the methods of data collection?	• Representative, large sample • Standardized instruments	• Informative, small sample • Observations, interviews
What is the form of reasoning used in analysis?	• Deductive analysis	• Inductive analysis
How are the findings communicated?	• Numbers • Statistics, aggregated data • Formal voice, scientific style	• Words • Narratives, individual quotes • Personal voice, literary style

Justification of Qualitative Design

This study uses a qualitative research design to answer the research question posed in Chapter 1. The basic characteristics and assumptions of qualitative research are met by this problem. Specifically, qualitative research is descriptive and inductive in nature and it involves fieldwork where the researcher is primarily concerned with the process, interested in personal meaning, and the primary instrument for data collection and analysis (Creswell, 1994:145). This research effort seeks to map the DSCC DMSMS reactive management strategy by interviewing and observing the participants in the process. The conclusions and recommendations are descriptive and result from inductive logic.

Types of Qualitative Designs. Although authors have written about as many as 20 qualitative design types (with origins in fields such as anthropology, education, history, human ethnology, psychology, and sociology), commonly qualitative research is conducted using one of five designs. These designs are the case study, ethnography, phenomenological study, grounded theory study, and content analysis (Leedy and Ormrod, 2001:157). Table 2 lists each of these designs with their distinguishing characteristics.

A case study is used to study in-depth the DSCC's DMSMS reactive management strategy over a four-month timeframe, September 2001 – December 2001. The data for this case study were collected via observations, interviews, and content analysis of archival data.

Table 4. Distinguishing Characteristics of Qualitative Designs (Leedy and Ormrod, 2001:157)

Design	Purpose	Focus
Case study	To understand one person or situation in great depth	One case or a few cases within their natural setting
Ethnography	To understand how behaviors reflect the culture of the group	A specific field site in which a group of people share a common culture
Phenomenological study	To understand an experience from the participants' point of view	A particular phenomenon as it is typically lived and perceived by human beings
Grounded theory Study	To derive a theory from data collected in a natural setting	Human actions and interactions, and how they result from and influence one another
Content analysis	To identify the specific characteristics of a body of material	Any verbal, visual, or behavioral form of communication

Disciplines Using the Case Study Design. Although the case study design is generally characterized as a weak sibling among social science methods, it is used extensively in social science research (Yin, 1984:10). The fields using case study methodology include psychology, sociology, political science, anthropology, history, economics, public administration, and education. Dr. Yin proposes that the reason the case study methodology is so prevalent in social sciences (despite the stereotype) is that the stereotype is wrong (Yin, 1984:10). This proclaimed leader of the nonlaboratory social science methodology describes the case study strategy as a rigorous method of research (Yin, 1984:9-11).

Definition of the Case Study Design. A technical definition of the case study strategy is offered by Dr. Yin. He states that "a case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context when the boundaries between phenomenon and context are not clearly evident and in which multiple sources of evidence are used" (Yin, 1984:23). Case study designs are generally used when questions such as why and how are being answered and the researcher has little or no control over the events.

Explication of Participants and Relationships

Because qualitative research is interpretative in nature, it is recommended that the values, biases, and judgment of the researcher be explicitly stated in the research report (Creswell, 1994:147). To that end, listed below is an explication of the DSCC DMSMS Office, an explanation of how entry into the DSCC DMSMS Office was gained, an introduction to the gatekeeper, a description of the researcher's experience, and the researcher's level of involvement.

DSCC. The DSCC DMSMS management structure is listed in Appendix B. The organizational chart lists the many specialties within the DSCC DMSMS Office. These specialties are program management, systems analyst, contracting, engineering, system administrator, supply system analyst, and equipment specialists.

Gaining Entry. According to qualitative researchers, the steps taken to gain entry into the DSCC DMSMS Office and to secure permission to study the informants and the DMSMS management procedures should be discussed (Creswell, 1994:147). Initial contact with DSCC (see Appendix C) was sent on 11 September 2001. A follow-

up call was placed on 19 September. Mr. Robinson, the DSCC DMSMS Program Manager, stated that they would be interested in helping with this research effort and that the point of contact would be Mr. George Shkane. The initial meeting took place on 25 September, and consisted of meeting the DMSMS Office staff. The researcher's questions were kept generic and open-ended. The initial contact with DSCC ended with the attainment of a research sponsor, a desired product from this research effort, and an invitation to return as often as possible.

Gatekeeper. It is important to gain access to research or archival sites by seeking the approval of a gatekeeper (Creswell, 1994:148). Mr. George Shkane, the DMSMS Systems Administrator, was the gatekeeper for this research effort. Mr. Shkane provided an extensive introduction into the DSCC DMSMS reactive management strategy and established times to interview and observe the other members of the DMSMS Office. Mr. Shkane provided access to archival records and was the primary point of contact between DSCC and the researcher.

Experience of the Author. As stated in Chapter 2, the author had no a priori knowledge of the DMSMS phenomenon. Much of the background knowledge of DMSMS came from reviewing the literature and interviewing Mr. James Neely and Mrs. Monica Poelking of the Air Force Research Lab (AFRL). Their office serves as the Air Force DMSMS Hub. Both sources of information identified electronic components as the core of DMSMS problems. If electronics were the core of DMSMS problems, then DSCC as the primary electronic component manager for fielded weapon system spares would be the logical place to start asking questions.

With nearly 10 years of medical supply experience, the researcher was familiar with many of the tools used by DSCC to conduct item research. Much of the supply language is the same whether the item being referred to is a box of band-aids or a piece of complex avionics (e.g., NSN, FSC, and UI). However, the researcher had never been exposed to DMSMS or the management strategies used to combat it.

Level of Involvement. Extensive fieldwork was used to gather the information needed for this research effort. This research began as an independent effort without sponsorship. Early interviews with Air Force DMSMS management specialists provided a place from which to start. Once entry had been made and a gatekeeper established at DSCC, the process of getting information became straightforward. Visits to DSCC occurred between September 2001 and December 2001. While conducting interviews and observing the DMSMS reactive management process, the researcher was given the opportunity to conduct in-depth research on several items. The overall level of involvement would best be described as that of a participant observer (Creswell, 1994:150).

Description of Methodology

A case study method was used to explore the research questions posed in Chapter 1. This research effort was initiated with a review of literature, which provided the basis of understanding needed to conduct interviews and make observations. Listed below is an explanation of how the data were collected and analyzed. In addition, a brief section on human subject information is included for clarity.

Data Collection. As described by Leedy and Ormrod, and Creswell, there are three methods of data collection in a case study. These methods are observations, interviews, and content analysis of the appropriate written documents and/or audiovisual material. However, it has been said that in qualitative research, the researcher's quest for potential data sources is limited only by his or her open-mindedness and creativity (Leedy and Ormrod, 2001:158). Table 3 lists the options within types, the advantages of the type and the limitations of the type.

Table 5. Qualitative Data Collection (Creswell, 1994:150-151)

Type	Options	Advantages	Limitations
Observations	Complete participant Observer participant Participant as observer Complete observer	Researcher has firsthand experience with informant Researcher can record information as it occurs Unusual aspects can be noticed during observation Useful in exploring uncomfortable topics	Researcher may be seen as intrusive "Private" information may be observed that cannot be reported Researcher may lack skills Certain informants may present special problems
]Interviews	Face-to-face Telephone Group	Useful when informants cannot be directly observed Informants can provide historical information Allows researcher "control" over the line of questioning	Provides "indirect" information Provides information in a designated "place" Researcher's presence may bias responses Not all people are equally articulate and perceptive
Documents	Public documents Private documents	Enables a researcher to obtain the language and words of the informant Unobtrusive source of information	May be protected information unavailable to public or private access Requires the researcher to search out information in hard-to-find places

Observations. Of the two types of observation techniques, observation as a relative outsider or as a participant observer, the researcher opted for the latter (Leedy and Ormrod, 2001:158). The gatekeeper, Mr. Shkane, introduced the researcher to the DMSMS staff and briefly described the study. Despite the major disadvantage of the researcher's presence, the DMSMS professionals were open to discussion and willing to be observed while conducting business. Written notes were taken during each session.

Interviews. Informant interviews were conducted concurrently with the observations of their processes. Mr. Shkane arranged for the interviews along with the observations and briefed the informants on the focus of the research effort and the desired end product. Questions were open-ended at the beginning of the fieldwork and became more structured as the research effort evolved.

Content Analysis of Archival Data. Content analysis conducted early in this research effort differs significantly from that conducted during the fieldwork portion. Early content analysis focused on the researcher understanding the DMSMS phenomenon and the DoD DMSMS management framework. The content analysis conducted during the fieldwork portion of this research effort focused on materials obtained from the gatekeeper. This archival data included the past DMSMS guidance and a process flowchart, both of which became obsolete in 2000 when DMSMS management responsibility shifted from the item managers at DSCC to the DMSMS Office.

Data Analysis. It has been said of data analysis for qualitative research that there is no right-way in which to do it (Creswell, 1994:153). For this research effort, data analysis occurred simultaneously with data collection. The primary methods of data

analysis for case study designs are categorization and synthesis (Leedy and Ormrod, 2001:157).

Human Subject Information. The participants in this research effort are all government civilian employees. The researcher sent a request to the Civilian Personnel Office to ensure the use of their names in the research report did not violate their right to privacy. The Civilian Personnel Office forwarded the request to their lawyers for review. Appendix D is the clarification message sent to the DSCC Civilian Personnel Office at the behest of their attorney, Mr. Darryl D. Brown.

Mr. Brown later replied that nothing prohibited the use of their names provided the individual being cited had no objection (Brown, 2001).

Description of the Process Mapping Tool

Once an understanding of DSCC DMSMS reactive management strategy was attained, a cross-functional process map of the process was developed using Microsoft Visio®. A cross-functional process map is a graphical representation of the sequence of steps that make up a process. They make work visible providing improved communication, understanding, and a common frame of reference for those involved in the work process (Damelio, 1996:1). Microsoft Visio® is a software application designed to help the user visualize, document, and share ideas with attention-grabbing flowcharts, organization charts, office layouts, and so on.

Process maps were developed and sent/taken to DSCC for their critiques. Multiple iterations were accomplished to ensure the process was captured completely.

Validity and Reliability

Validity and reliability in qualitative research is controversial. Some posit that qualitative researchers have no single stance or consensus concerning validity and reliability (Leedy and Ormrod, 2001:157). In this research effort, internal validity is sought among the data gathered through convergence. Internal validity ensures the accuracy of what is being recorded and how well it matches reality. Additional strategies such as extensive time in the field and respondent validation are used to support the internal validity of this research effort (Leedy and Ormrod, 2001:106). Case studies using multiple sources of information were rated higher in overall quality than studies relying only on a single source of information (Yin, 1984:91).

External validity is somewhat more problematic. The nature of the case study limits the generalizability of this thesis, threatening external validity. No special technique exists for assessing external validity of quantitative research, which means that qualitative research is at no disadvantage (Dooley, 2001:261).

Reliability or the exact replication of the results in other settings may not be possible, but every effort has been made to describe the researcher's knowledge of the subject, the research assumptions, and how and why the DSCC was chosen. By providing this information, the chances of replicating the findings of this research effort in another setting are enhanced (Creswell, 1994:159).

Chapter Summary

The purpose of this chapter was to provide an explanation of the methodology used to accomplish the research objective. Initially, this chapter provided an overview of

qualitative research design. Then, a brief description of the different types of qualitative designs were described along with their disciplines of origin, definition of design, and any special characteristics that they have. After that, a justification was given for using a qualitative design for this study, which was accompanied by a discussion of its assumptions and suitability.

After the theoretical groundwork was laid, an explication of the participants and the relationship between them was detailed followed by the experience and the level of involvement of the researcher. Then a complete description of the research methodology for this thesis was described, to include how data were collected, analyzed, and what tools were used to create the final product. The chapter ended with a discussion of validity and reliability.

IV. Analysis and Results

Chapter Overview

The purpose of this chapter is to answer the overall research question by answering the sub-questions posed in Chapter 1. The research methodology established in Chapter 3 was employed to ascertain the answers to these sub-questions and investigative questions where applicable. Initially, this chapter provides the context of data presented. Then the data are presented in two separate sections. The first and largest section details the data collection, and the second section details how the data were refined to produce the updated guidance and process map. This chapter ends with each sub-question being restated and answered using the data gathered.

Context of Data Presented

To fully understand the context of the data, the first two steps of Theory of Constraints (TOC) integration were applied to the DSCC DMSMS Office. The TOC is an overall philosophy for running or improving an organization (AGI, 2001). It was developed by Dr. Eliyahu M. Goldratt and introduced to the world in his 1984 book, *The Goal: A Process of Ongoing Improvement.*

The first step of TOC integration is to "define and scope the system (who are we in relationship to our environment?)" (Swartz, 2001). This step involves identifying the boundaries, inputs, processes, and outputs of the system. Figure 3 depicts the entire system in these terms.

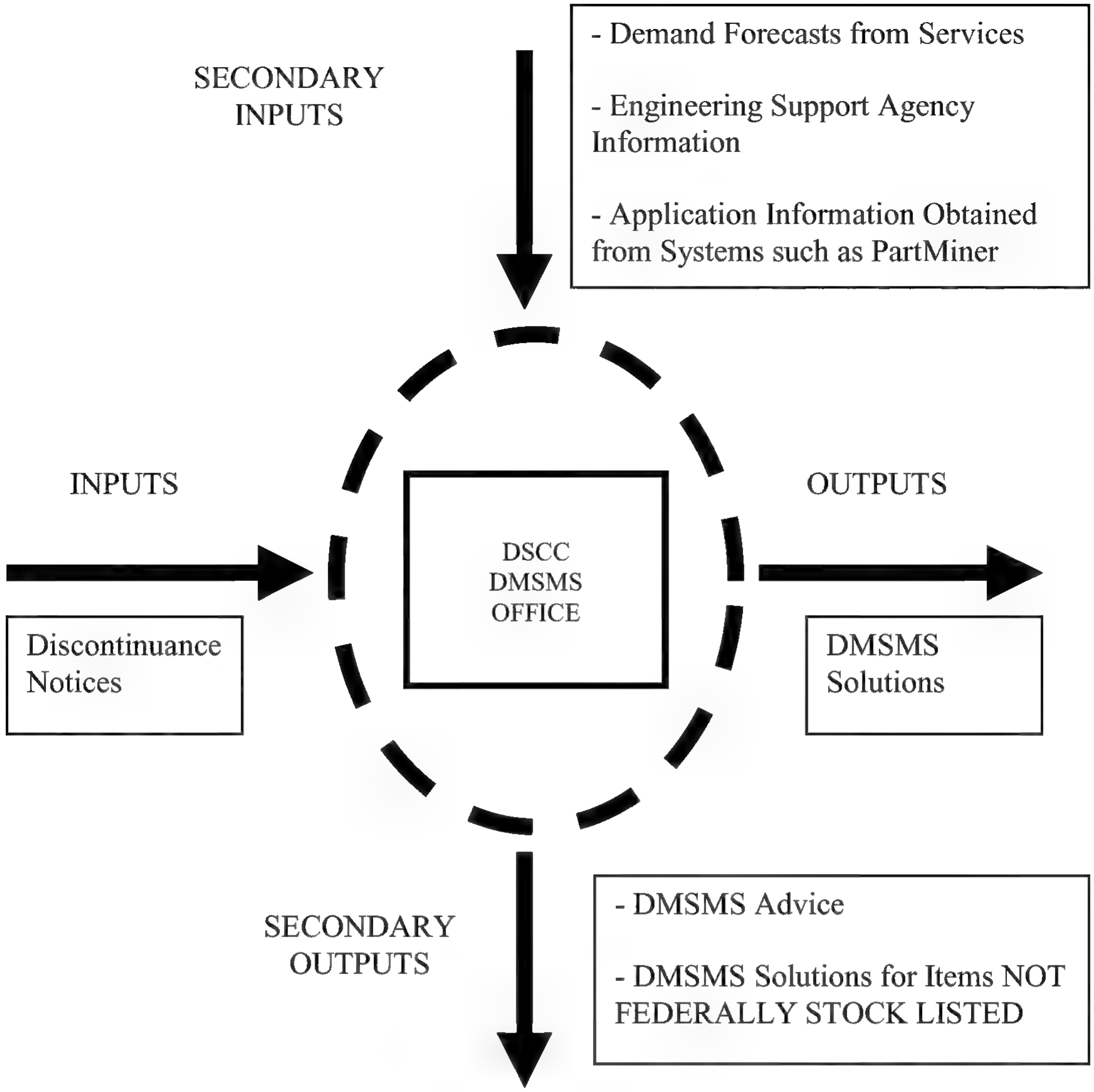


Figure 3. Theory of Constraints Integration

The boundary is the dotted line that separates the DMSMS office from its environment. By establishing a clear boundary, the system can be improved, which is the ultimate goal of this research effort. The primary input into this system is an item discontinuance notice. Discontinuance notices can originate from the manufacturer, the supplier, the customer, or they can come from other DMSMS management agencies,

namely the Government Industry Data Exchange Program (GIDEP). Secondary inputs are the data needed to achieve a DMSMS solution. These include the lifetime requirement estimates that customers provide and DSCC uses to compute Life-of Type (LOT) buy quantities, the engineering advice from the customers Engineering Support Activity (ESA), and the information taken from government and industry managed databases. The primary output of the system is DMSMS solutions for DSCC managed items. Secondary outputs consist of advice given to other DMSMS management agencies at both the service and the System Program Office (SPO) level, and DMSMS solutions for items that are not federally stock listed (Shkane, 2001d). The last secondary output originally stated DMSMS solutions for non-DSCC managed items, but was changed after consultation with members of the DMSMS Office.

In the second step of TOC integration, the performance measures must be specified and quantified in order to determine if things are getting better or worse (Swartz, 2001). A clear understanding of the goal is requisite before attempting to define these metrics. In their previous guidance (see Appendix N), the DMSMS Office had stated their goal as "…to assure ongoing availability of electronic/construction parts to all customers, "including Foreign Military Services (FMS)," irrespective of their availability in the marketplace and to provide this service as cost effectively as possible." Discussion of the goal with Mr. Shkane lead to the elimination of the redundant phrase, including Foreign Military Service (FMS), and the elimination of the necessary condition of providing the service in a cost effective manner. The revised goal that was agreed upon was "assure ongoing availability of DSCC-managed items to all customers irrespective of their availability in the marketplace" (Shkane, 2001d).

Having a clear picture of the system and a concise goal allowed for the definition of system metrics. The TOC uses three primary system metrics. They are throughput, inventory, and operating expense (see Table 6).

Table 6. System Metrics

Throughput	DMSMS solutions
Inventory	Notices currently in the system
Operating Expense	Staff, equipment, etcetera

Throughput is best defined as "the rate of goal attainment" (Swartz, 2001). For companies in business to make a profit, the goal is clear, to make money now and in the future (Goldratt and Cox, 1984:41). Not-for-profit organizations are different and require careful examination of their purpose and goal. For this system, the goal is clear and throughput is defined as a DMSMS solution. This took considerable time to comprehend because the output is not a physical item; rather the output is an item's status. Inventory is comprised of the inputs received by the system that have not been converted into throughput. Operating Expense is the cost of converting an item discontinuance notice into a DMSMS solution. For this system, operating expense is almost entirely fixed.

The third and final step of TOC integration is to attack the system on two fronts. The first front is fought from within the system and the second front is fought between the system and its environment. These attacks apply both application tools (e.g., Total Quality Management) and logic tools (Goldratt's Thinking Processes) (Swartz, 2001). Application of these tools to this research effort is beyond the scope of this current research, but it was added to the recommendations for future research section.

The data presented in this chapter pertains to the operations within the system, the DSCC DMSMS Office. In the context presented above, this research seeks to improve the system in order to increase throughput, decrease inventory, and reduce or hold constant operating expense.

Presentation of Data

As described in Chapter 3, three methods of data collection were used in this case study. These methods were observations, interviews, and content analysis of the appropriate archival data. Questions were open-ended at the beginning of the fieldwork and became more structured as the research effort evolved. As such, this section can easily be divided into two phases, data gathering and data refinement.

Data Gathering Phase. During this phase, September – October 2001, the researcher asked a few open-ended questions. This was done in an attempt to draw out information without stifling or leading the informants. Interviews and observations were conducted on 25 September 2001, 11 October 2001, and 25 October 2001. Archival data were also gathered and analyzed during this phase.

Observations and Interviews. Informant interviews were conducted concurrently with the observations of their processes. Despite the major disadvantage of the researcher's presence, the DMSMS professionals were open to discussion and willing to be interviewed and observed while conducting business. Written notes were taken during each session. The gatekeeper, Mr. Shkane, introduced the researcher to the DMSMS staff. Mr. Shkane arranged for the interviews along with the observations and briefed the informants on the focus of the research effort and the desired final product.

The researcher's initial contact was with Mr. Shkane and then Mr. Robinson to discuss the research effort and its focus. As this effort was exploratory in nature, the initial research focus was later adapted to meet the needs of the DSCC, the newly garnered sponsor. Mr. Robinson stated the need for updated guidance and an objective analysis of their office's processes. Interviews and observations of other functions of the DMSMS Office followed.

The first interview was with Mr. Shkane, the System Administrator. He explained the various sources of discontinuance notices. GIDEP is the primary source, but notices can come from manufacturers, suppliers, other DMSMS management agencies, and customers (Shkane, 2001a). The multiple overlapping sources of information require the careful screening of notices to prevent duplication. Mr. Shkane's primary responsibility is to determine the validity of the notice, assign a case number based on the last-time buy date, update the GIDEP database, and work with the rest of the office to assign an engineer to the case and establish milestones. Mr. Shkane allowed the researcher into their database to check for duplicate cases and granted access to the Shared Data Warehouse (SDW).

Next was the interview with Mr. Beckstedt, the General Emulation of Microcircuits (GEM) Manager. The GEM program was in the Research and Development phase in 1987, was validated between 1992 and 1997, and started production in 1997 (Beckstedt, 2001). The contract with Sarnoff allows the GEM program access to a flexible foundry at an annual investment of $2 million. Unfortunately, the complexity of microcircuits limits what GEM can produce. Currently, GEM is not capable of emulating microcircuits produced after the early 1980s

(Beckstedt, 2001). With the average cost of emulation around $250,000 not including the time investment, GEM is discouraged for most parts.

The third interview was with Mr. Besore, one of the three Engineers within the DMSMS Office. Mr. Besore explained what actions are taken when a case is assigned to an engineer. The engineer is responsible for creating and completing the Technical Spreadsheet (see Appendix E). Various sources of information are used to fill in the spreadsheet. The Federal Logistics Information System (FLIS) is used to determine if the item is stock listed and if it is stock listed, who the Primary Inventory Control Authority (PICA) is. The PICA is a two-digit code that identifies the agency that is responsible for the item. The PICA for DSCC is TX. Another system used in completing the spreadsheet is PartMiner, which was explained in detail in Chapter 2. For the DSCC managed items, the engineers check for substitutes and alternate sources of supply (also called Continuing Alternate Source (CAS)). If the item is coded as critical, coordination of a substitute is required with the customer's ESA via Form 339. When the spreadsheet is completed, it is forwarded to the Supply Systems Specialist. The engineer also generates a DMS Technical Data Certification Sheet (see Appendix F).

The last of the initial interviews was with Mr. Peyton, the Supply Systems Specialist. Mr. Peyton provides the interface between DSCC customers and the DMSMS Office. He reviews the Technical Spreadsheet. No action is taken for DUP and CAS items. For the others, he generates two types of notifications based on the information contained on the spreadsheet. The first notification is sent to services for service managed DMSMS items (see Appendix G) alerting them to the item's discontinuance. The second notification is the Initial Alert Notification letter (see Appendix H) for DSCC

managed items, which notifies the service of the item's discontinuance and requests projected lifetime requirements. This notification is sent to the entire DMSMS points of contact mail group. Mr. Peyton builds the Requirements Spreadsheet (see Appendix I) and initiates a DMS Manual Purchase Request (see Appendix J) for two years of stock (if required) based on the item's historical file. When lifetime requirements are received from the service(s), they are checked for congruence with the item's demand history. If the estimates appear illogical, the service is required to justify their computation (see Appendix K). Purchase request quantities are then recomputed based on service estimates. Based on the size of the order, the item is evaluated using the GEM Checklist (see Appendix L) for possible emulation. The DMS Certification Document (Appendix M) is produced to document the exercise of the National Defense Authorization Act, which grants authority for the purchase of excess inventory in the interest of national security.

Another trip to DSCC on 11 October 2001 provided an opportunity to receive documentation from Mr. Shkane. A brief discussion of the documents and their applicability was performed.

During the third trip to DSCC on 25 October 2001, Mr. Shkane and Mr. Besore were interviewed to ensure their portions of the process were understood. Mr. Shkane again explained his steps and allowed the researcher to work several discontinuance notices. He also detailed the Management Assistant's contribution to the process and how the various databases are updated. Mr. Besore did the same for the engineering steps of the process. When questioned about the extent of their research, Mr. Besore stated that much of the same research was conducted for non-DSCC managed items.

Follow-up to that question revealed that even though the information was being placed on the spreadsheet, it was not being forwarded to the services. This will be covered in the recommendations for action section.

Archival Data. After the initial visit to DSCC, Mr. Shkane compiled an extensive set of DMSMS guidance, both external and internal to DSCC. The external guidance consisted of DoD 4140.1-R *DoD Materiel Management Regulation*, Defense Logistics Agency (DLA) Regulation 4005.6 *Diminishing Manufacturing Sources and Materiel Shortages (DMSMS) Program*, and DLA Integrated Policy Memorandum NO. 97-0003A *Diminishing Manufacturing Sources and Materiel Shortages (DMSMS) Program* (see Appendix N). The internal guidance included the *IM Desk Guide for DMS Case Processing*, a checklist entitled DMS Internal Process Flow (see Appendix O), and a draft copy of intra-office guidance

During the second visit to DSCC on 11 October 2001, Mr. Shkane turned over copies of these materials. Unlike the focus of the initial literature review, this material was analyzed for specific insight into DSCC's processes. The focus of the external documentation centers on what must be done rather than how things are done, which is the focus of this research effort. However, the internal guidance provided a detailed account of how DMSMS management tasks are accomplished. Much of it is no longer valid because of the reassignment of DMSMS responsibilities. In 2000, the responsibility for DMSMS management at DSCC shifted from the item manager to the DMSMS Office. The draft copy of intra-office guidance written by Mr. Huy Dang provided a better picture of DMSMS processes within DSCC; however, it did not include GEM or the Management Assistant in the DMSMS management strategy.

Data Refinement Phase. During this phase, November – December, the researcher asked very pointed questions to fill in gaps in knowledge from the data gathering phase, and completed and validated the cross-functional process map. Interviews and observations were conducted on 29 November 2001 and 17 December 2001. Archival data was relied upon to provide the framework to construct updated DMSMS Office guidance during this phase.

The Cross-Functional Process Map. After the first attempt at constructing a cross-functional process map, it was taken to DSCC for review. On 29 November 2001, Mr. Shkane reviewed the cross-functional process map. One of the objectives of that trip was to receive support for the cross-functional process map method rather than the flowchart method, which provides a disjointed picture of the DMSMS management process. The cross-functional process map is more suited to the DMSMS Office because its focus is on the process/people interface and it shows the functions, steps, inputs and outputs of a process (Damelio, 1996:xi). Mr. Shkane readily accepted the design and reviewed the process map. The following recommendations were received:

1. Management Assistant updates the SDW and DMS database only after the engineer has completed the Technical Spreadsheet
2. After the engineer checks to see if the item is stock listed only DSCC managed items are reviewed for substitutes and alternate sources
3. Add 2 year purchase request step in the Supply System Analyst section
4. Add in that engineering notifies provisioning engineers that the item is being discontinued (Shkane, 2001d)

These recommendations were incorporated and the process map was completed. On 17 December 2001, the updated cross-functional process map was critiqued by

several members of the DMSMS Office. The objective was to ensure each step of the process was captured accurately and sequenced appropriately. The following recommendations were received:

1. The Systems Administrator updates GIDEP after the Initial Alert Notification letter is sent

2. Add decision step after contract is solicited to account for no-bid contracts (Robinson, 2001c and Shkane, 2001e)

With those minor corrections, Mr. Robinson and Mr. Shkane accepted the cross-functional process map (see Appendix Q).

The Updated DMSMS Office Guidance. The new guidance (see Appendix P) relied heavily on the past guidance for structure and it incorporated all of the steps listed in the cross-functional process map. The guidance was created in an iterative process. It was drafted and sent to DSCC via e-mail and reviewed during the 17 December 2001 visit. During that time, the draft guidance was critiqued and returned for changes. The following recommendations were received:

1. In the Background section, change also called an aftermarket manufacturer to like an aftermarket manufacturer

2. Eliminate the discussion of GEM in the produce a substitute item paragraph

3. Under the responsibilities of the Chief, DSCC-CCD add GEM Program Manager

4. Keep all appendices and add an appendix for the GEM Checklist

5. Where appropriate make reference to the applicable appendix (Robinson, 2001c and Shkane, 2001e)

The changes were incorporated and the guidance was resent to DSCC. With those minor corrections, Mr. Robinson and Mr. Shkane accepted the guidance. This iterative

process was intended to add validity to the product and it provided an excellent feedback loop.

Research Questions Answered

The purpose of this research effort is contained within the overall research question: "Can the current DMSMS management strategy used by DSCC be improved?" To answer this high-level, over-arching question, several sub-questions (listed below) were answered. Some of these sub-questions are broken down further by using investigative questions.

What is the current DSCC DMSMS management strategy? At the request of the sponsor, a process map of the current process and a supplement to the applicable Defense Logistics Agency (DLA) was produced (see Appendices P and Q). As described above, the information necessary to produce these products were gathered via observations, interviews, and content analysis of written material. The following questions were developed and answered to shed light on their DMSMS management process.

Is the strategy predominately proactive or reactive? As described in the literature review, DMSMS mitigation strategies can generally be considered proactive or reactive in nature. Proactive strategies address DMSMS issues early during system development. Reactive management strategies are used when reacting to manufacturer's intent to discontinue production of an item needed to support a weapon system.

As the Primary Inventory Control Authority (PICA) for most electronic parts, DSCC, through the use of the reactive strategies listed on Table 2, must ensure availability of DSCC managed items regardless of their availability in the marketplace.

Who are the members and what are their specialties? The DSCC DMSMS management structure is listed in Appendix B. The organizational chart lists the many specialties within the DSCC DMSMS Office. These specialties are program management, systems analyst, contracting, engineering, system administrator, supply system analyst, and equipment specialists. Individuals form each of these specialties were interviewed and observed to better understand their contribution to the DMSMS management process.

How is information transferred? Mr. Shkane, the System Administrator, explained the various sources of discontinuance notices. GIDEP is the primary source, but notices can come from manufacturers, suppliers, other DMSMS management agencies, and customers (Shkane, 2001a). During regularly held office meetings new cases are assigned to one of three engineers and milestones for the cases are established. After case assignments, Mr. Shkane updates the GIDEP database and maintains a spreadsheet to monitor milestones. At various points in the process Mr. Anderson, the Management Assistant, updates the Shared Data Warehouse (SDW) and the DSCC DMS Database. Appendix G graphically depicts the flow of information through the various specialists.

How are records stored? DMSMS files are maintained in both electronic file and paper file. Folders in the shared drive are maintained by Mr. Shkane. These files are separated by year and by case number. Each case file contains all of the

information for that case. Such as the discontinuance notice, any duplicate notices, all e-mail correspondence, the technical spreadsheet, the initial alert message, and any other pertinent data. Paper files are kept for backup purposes and contain the same information.

What agencies, initiatives, and tools are being incorporated in their strategy? In conducting the initial literature review; numerous agencies, initiatives, and tools were found that deal with DMSMS. The more important ones were explained in Chapter 2. To understand how DSCC incorporated them into their DMSMS strategy, the following questions were developed and answered.

What agencies provide inputs to the DMSMS Office? GIDEP is the primary source of discontinuance notices, but notices can come from manufacturers, suppliers, other DMSMS management agencies, and customers (Shkane, 2001a). Agencies that provide procedural inputs to DSCC include the DoD, DLA, and DMEA.

What agencies require the output of the DMSMS Office? Although the actual item status is not desired by the customer, the availability of the DSCC managed item at the time of request is important and paramount to maintaining the availability of an aging arsenal.

What initiatives are used by DSCC to combat DMSMS? Members of the DSCC actively participate in DMSMS conferences and other events providing avenues of cross talk between DMSMS management specialist. Mr. Besore is the DSCC representative to the DMSMS Teaming Group, which was discussed in Chapter 2.

What tools are part of their DMSMS management strategy? The tools used by the DMSMS office include PartMiner, the FLIS, and many of the typical Microsoft Office applications.

What are the current issues/problems/limitations with their strategy? As the intermediary between the marketplace and the services, DSCC's issues, problems, and limitations can be listed accordingly. Those they face with companies that supply electronic parts, and those they face with the services.

What are these with respect to companies? There is no industry standard for notifying customers that a company wishes to discontinue a product line. Companies wishing to discontinue a product can simply stop production. However, companies generally provide notification of their intent. This notification may take a circuitous route before finding its way to DSCC. GIDEP is the primary source of discontinuance notices, but notices can come from manufacturers, suppliers, other DMSMS management agencies, and customers. Frequently these notices provide a short lead-time and may not provide a last time buy opportunity at all.

What are these with respect to the services? If a notice is received with a shot lead-time, the time given to the services to calculate future requirements is also limited. Services are asked to predict requirements for the remainder of the weapon system's projected service life, which could exceed 20 years. This long-range forecasting done under a time constraint can lead to inaccurate forecasts. For those forecasts, DSCC bears full responsibility (to include loses if inventory is not used) of ensuring stocks are on-hand.

The DMSMS engineers frequently work with engineers within the System Program Offices (SPOs) when evaluating substitute parts. This relationship works well for the non-critical items. During interviews, the ESA process in place for critical items was described as bureaucratic and time consuming.

How could their strategy be improved? Although recommendations will be covered in-depth in Chapter 5, the following were noted during the data-gathering phase of the research:

1. Focus on primary output and work to decrease the call for secondary output
2. Perform "as-requested" services for non-DSCC items
3. Reduce the bureaucracy between DLA and the ESA
4. Provide case resolution information to the customer

Chapter Summary

The purpose of this chapter was to answer the overall research question by answering the sub-questions posed in Chapter 1. The research methodology established in Chapter 3 was employed to ascertain the answers to these sub-questions and investigative questions where applicable. Initially, this chapter provided the context of data presented. Then the data are presented in two separate sections. The first and largest section detailed the data collection, and the second section detailed how the data were refined to produce the updated guidance and cross-functional process map. This chapter ends with each sub-question being restated and answered using the data gathered.

V. Conclusions and Recommendations

Chapter Overview

The purpose of this chapter is to discuss the findings from this research effort, including what the findings were, their significance, and their implications. Recommendations for action are presented based on these findings. These recommendations address three areas; DSCC, the Services, and the DMSMS community. Recommendations for future research into the DMSMS phenomenon conclude the chapter.

Research Findings

A thorough review of the literature reinforced the early findings that most DMSMS cases involve electronic components, especially semiconductors and microcircuits. The FSCs hardest hit are 5961 and 5962, which are both primarily managed by DSCC. There are three main reasons for the electronic DMSMS problem within the DoD: long acquisition lead times and extended life cycles, decreasing market share, and the commercial profit motive.

While the DMSMS initiatives, proactive and reactive strategies, and civilian tools provide a spectrum of management alternatives for developing systems, managers of fielded weapon system spares are limited in their choices. As the primary source of supply for most electronic components, the DSCC must rely almost solely on the reactive management strategies.

Through observations, interviews, and content analysis of their office guidance, a cross-functional process map was drafted to represent the DSCC DMSMS management

strategy from notification of discontinuance to assured availability of the part. Using this visual representation of this process as a guide, a supplement to Defense Logistics Agency (DLA) Regulation 4005.6 *Diminishing Manufacturing Sources and Materiel Shortages (DMSMS) Program* was written.

Significance of Findings

In the Department of Defense (DoD), there is increased interest in reducing total ownership costs, and increasing the availability of its aging weapon systems. The DoD is continually forced to extend weapon system service life well beyond the intended service life. Effective program management that incorporates proactive approaches such as open architecture and the use of commercial-off-the-shelf items during the first stages of a program's life cycle can reduce some of the effects of later DMSMS issues. However, mature programs that are in the operation and support phase, the Integrated Materiel Manager (IMM) must counter DMSMS problems with the most cost effective reactive approach or resolution alternative that ensures program viability. As the IMM for most electronic spares, the DSCC confronts the largest number of DMSMS cases. Their resolution of DMSMS cases affects nearly every fielded weapon system.

DSCC manages nearly 2 million spare parts. Over the last decade, DSCC has received and managed more than 2000 DMSMS cases that involved nearly 90,000 part numbers. The continued availability of these items affects the ability of the U. S. military to maintain its aging arsenal. Improving the DMSMS management strategy of DSCC (however slightly) will help ensure America's ability to project power.

Implications of Findings

Suggested by the list of initiatives and the many offices of responsibility, DMSMS is a large problem that will pervade the U. S. military. This thesis concentrated on the DSCC DMSMS reactive management strategy. Because of this specificity, the applicability of the research findings may not be generalizable to other agencies within the DMSMS community. However, the complete case study of DSCC's DMSMS reactive management strategy may provide a methodology that others can use to improve their own DMSMS management strategy.

For DSCC, the increased visibility of the process should improve communication and understanding, as well as provide a common frame of reference for those involved in the work process and their customers. It would be difficult to quantify and predict the end-state improvements in parts availability or cost at this time.

Recommendations for Action

Based on the research conducted to produce the requested products for the DSCC DMSMS Office, the following recommendations are made to improve DMSMS management. These recommendations address three areas; DSCC, the Services, and the DMSMS community.

Within DSCC. Applying the first two steps of Theory of Constraints (TOC) integration to the DSCC DMSMS Office graphically illustrates the need to focus on their primary output, DMSMS solutions. During the course of the fieldwork used to complete this research, no fewer than four trips were taken to brief assorted individuals and

customers on DSCC DMSMS management procedures. While this may be worthwhile, it is not in line with their goal.

Although not represented on the cross-functional process map, considerable time had been devoted to finding DMSMS solutions for non-DSCC items. As the updated process map illustrates, only DSCC managed items should be researched by engineers. If practical, the organization could provide as-requested help to services for non-DSCC managed items.

The bureaucracy that exists between the DLA and ESA hampers the ability of the engineers to find solutions to DMSMS problems quickly. With many discontinuance notices providing little time to research alternatives, the time needed to coordinate solutions through the Form 339 process is too great. Engineers are forced to recommend LOT or bridge buys to ensure that the part is available.

During the second interview with Mr. James Neely, he stated that the services are not advised of the actions taken by DSCC to resolve DMSMS issues. A feedback loop was included in the cross-functional process map. Updates to the Shared Data Warehouse (SDW) and GIDEP are done following each major step in the DMSMS management strategy. Although identified for deletion by one of the reviewers, the last update to the SDW and GIDEP was approved by Mr. Robinson and is now part of their process.

Services. Service interaction with DSCC is vital to ensure the availability of spare parts for DoD weapon systems. Of greatest importance, is the need for services to provide accurate and timely forecasts when requested by DSCC. Knowledgeable and accessible engineers are needed at the ESAs to answer questions regarding items

identified as DMSMS. Empirical evidence of the effectiveness of proactive measures have yet to be demonstrated; however, practicality would dictate that greater use of these proactive measures by the services' System Program Offices (SPOs) will provide greater flexibility to DSCC when combating DMSMS.

Throughout the DMSMS Community. Despite the high level attention DMSMS is currently receiving, there appears to be no single DMSMS manager. With its plethora of initiatives, agencies, and tools a single DMSMS management agency is needed to ensure each work in concert to ensure the viability of our fighting force.

Recommendations for Future Research

Several opportunities for future research into the DMSMS phenomena exist. The short list below represents the topics most interesting to this author.

1. Conduct the same evaluation of the DMSMS management strategy of System Program Offices (SPOs). Develop a process map of the proactive management of the DMSMS phenomenon. Comparative studies between the SPOs would also be beneficial to the understanding of the difference faced by newer weapon systems.

2. Conduct a cost versus benefit analysis of the affects of Proactive DMSMS strategies on the long-term availability of spare parts. Seek to identify the most effective proactive measures.

3. Determine if the current SPO environment is conducive to decisions being made based on total ownership costs. With the different types of monies and the pressure to stay within budget, determine if program managers are rewarded for reducing system life cycle costs.

4. Investigation of the effectiveness of the storage and dissemination of DMSMS data. Large amounts of time and money have been poured into program like GIDEP and the SDW. Determine if the benefits of these systems outweigh their costs.

5. Determine the contribution of the innumerable DMSMS programs and initiatives. There seems to be a DMSMS program or initiative for every aspect of the phenomenon. Research in this area would determine what contribution each of them make to the management of this problem.

6. Develop a process map of the ESA interface between DSCC and Services to determine the areas of possible improvement. The ESA process has been identified as bureaucratic and time-consuming. If the process were mapped and evaluated, bottlenecks could be identified and eliminated. This could provide more time to resolve DMSMS issues involving critical items.

7. Determine the affect that the USC Title 10 limit on LOT buy quantities has had on spare part availability. With the exceptions that immediately followed the LOT buy quantity reductions, has there been a real decrease in LOT buys?

Chapter Summary

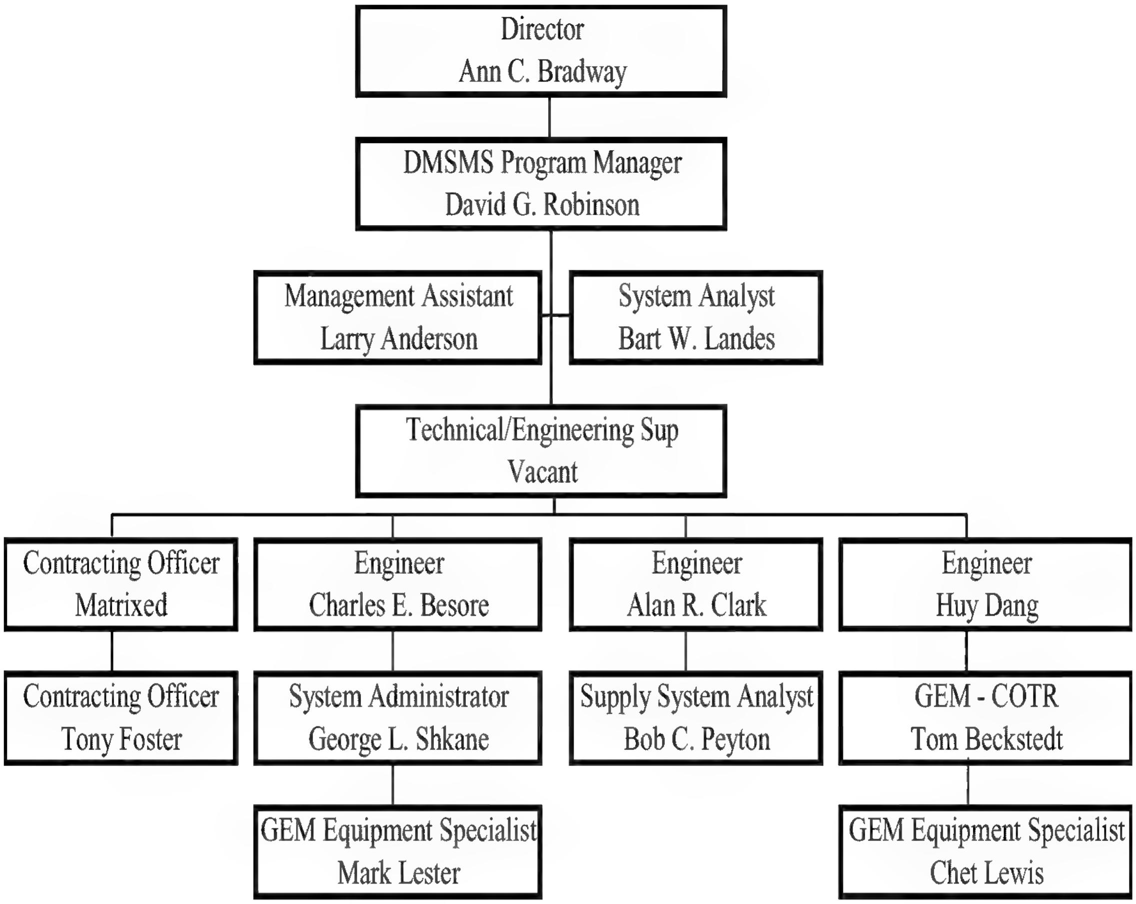
The purpose of this chapter was to discuss the findings from this research effort, including what the findings were, their significance, and their implications. The researcher made recommendations for action based on these findings. These recommendations addressed three areas; DSCC, the Services, and the DMSMS community. Recommendations for further research into the DMSMS phenomenon concluded the chapter.

Appendix A. Glossary of Acronyms

API	Application Programs Indenture
ASIC	Application Specific Integrated Circuits
AVCOM	Avionics Component Obsolescence Management
CAGE	Commercial and Government Entity (Code)
COTS	Commercial-Off-The-Shelf
DESC	Defense Electronics Supply Center (Now DSCC)
DLA	Defense Logistics Agency
DMEA	Defense Microelectronics Activity
DMSMS	Diminishing Manufacturing Sources and Materiel Shortages
DSCC	Defense Supply Center Columbus (Formerly DESC)
DTC	DMS Technology Center
EPOI	Electronics Parts Obsolescence Initiative
F^3I	Form, Fit, Function, Interface
FMS	Foreign Military Sales
FSC	Federal Stock Class
GIDEP	Government-Industry Data Exchange Program
IMM	Integrated Materiel Manager
LOT	Life-of-Type
LRU	Line Replaceable Unit
MDC	Manager Designator Code
MPCAG	Military Parts Control Advisory Group
MPN	Manufacturer Part Number
NHA	Next Higher Assembly
NIIN	National Item Identification Number
NSN	National Stock Number
OEM	Original Equipment Manufacturer
OPP	Out of Production Parts
P^3I	Preplanned Product Improvement
PPSL	Program Parts Selection List

R&D	Research and Development
RRT	Rapid Retargeting
RTOC	Reduction in Total Ownership Cost
TACTech	Transition Analysis of Component Technology
TOC	Total Ownership Cost
TSPR	Total System Performance Responsibility
VHDL	VHSIC Hardware Description Language
VHSIC	Very High Speed Integrated Circuit

Appendix B. Organizational Chart



Appendix C. Initial Contact to Gain Entry

11 September 2001

From: Overstreet Robert E 1Lt AFIT/ENS

To: 'Ann.Bradway@dscc.dla.mil'; 'David.Robinson@dscc.dla.mil'; 'George.Shkane@dscc.dla.mil'; 'Robert.Peyton@dscc.dla.mil'

Subject: Data Request for DMSMS Research

Ma'am/Sirs,

Good morning, I am a graduate student at the Air Force Institute of Technology. My thesis is in the area of DMSMS. Specifically, I am interested in the relative effectiveness of the different resolution alternatives. The reason I am writing is to ask for your help. I desperately need data and would sincerely appreciate any help that you could give me in this research endeavor. My thesis is an independent research effort that can be tailored to include additional questions that you might have in this area. I don't need financial sponsorship, but I really need your help in getting data to analyze. Your DMSMS case files would be an excellent place to start for a time-series analysis of the effectiveness of the resolution alternative, the duration of its effectiveness, and possibly the recurring costs of the resolution alternative.

I have visited Mr. Neely at the Air Force Research Lab. His office consolidates demand data. He takes the discontinuance notices that are issued by DSCC, checks for indentured relationships, sends to the affected programs, consolidates the requirements, and sends back to DSCC. He referred to the process as consolidating LOT buy numbers. He does not know which DMSMS solution(s) are used to correct the problem.

Additionally, I have submitted my thesis proposal to Dr. Gary Maddux for possible presentation at the DMSMS Conference in March 2002. My advisor, Major Stephen M. Swartz, and I seriously want my thesis to contribute to this area of research.

Any help that you could give me would be greatly appreciated. I am available to come to DSCC anytime. Thank you in advance for your consideration.

Very Respectfully,
First Lieutenant Robert Overstreet

Appendix D. Request to DSCC Civilian Personnel Office

6 November 2001

From: Overstreet Robert E 1Lt AFIT/ENS

To: 'darryl.brown@dscc.dla.mil'

Subject: Human Subjects Information

Mr. Brown,

Thank you for the e-mail. A thesis is one part (albeit a large part) of the graduation requirement at the Air Force Institute of Technology (AFIT). In conducting my literature review, I found that most occurrences of Diminishing Manufacturing Sources and Materiel Shortages (DMSMS) involve electronics. I requested help from Mr. Robinson, the program manager for the DMSMS Office. We agreed that I could provide a product for them while completing my thesis. I'm receiving data but no financial support.

In conducting my qualitative research design, I will use interviews and observations to define the problem and triangulate the data to arrive at reasonable suggestions for improvement. Their names would be listed in the bibliography and in the text of the report. Qualitative design relies heavily on personal accounts of processes.

I sincerely appreciate the help and hope there is no problem with the thesis.

V/R
Lt Rob Overstreet

Appendix E. Technical Spreadsheet

CASE NO	NSN	PART NUMBER	PRIMARY REF	PICA	DUP CAS	NOTES
98-019	5905-00-660-6930	0839-0008	D203	TX		Review
98-019	5930-01-169-1471	0370-2862	0370-2862	TX		Review
98-019	~~5955-011718423~~	0960-0612	0960-0612	TX	98-001	
98-019	5980-01-362-6336	5061-1190	5061-1190	TX		Review
98-019	~~5999-01-276-4019~~	05384-60005	05384-60005	TX	98-003	
98-019	6625-01-176-8354	5385A	5385A	TX		Review
98-019	6625-01-260-0677	5384A	5384A	TX		Review
98-019	6625-01-305-0440	5386A	5386A	SE		USAF
98-019	5340-01-277-2485	1600-1185	1600-1185	KZ		USN
98-019	5340-01-373-8822	5041-6819	5041-6819	KZ		USN
98-019	5355-00-100-6778	0370-1005	0370-1005	KZ		USN
98-019	6625-01-361-3068	5386A-004	5386A-004	KE		USN
98-019	5975-01-343-4037	5041-8801	5041-8801	CX		DSCR
98-019	5995-00-904-6314	8120-2683	8120-2683	CX		DSCR
98-019	1010-01-166-0230	12600764	12600764			
98-019	6625-01-316-4249	5384A-001	5384A-001			

Appendix F. DMS Technical Data Certification Sheet

DMS TECHNICAL DATA CERTIFICATION SHEET

CASE: _________

CAGE: _________ **NAME:** ____

TECHNICAL RECOMMENDATION: ___

I certify that the above DMS case has been fully researched, it is complete and accurate as of this date and meets the requirements for the technical certification as stated in paragraphs 5 and 13 of the DMSMS Class J&A.

____

Technician/Symbol/Phone/Date

Comments:

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DSCC FORM 289C

Appendix G. Service Managed DMS Item

From: Peyton Robert DSCC/CCD

To: DMSMS POC

Subject: DMSMS Case Number 01-123, Validation Request

1. This Center has been advised by one of our manufacturers, Cypress Semiconductor, of the pending discontinuance of certain items. In reviewing the list of stock numbers / part numbers it was noted that the following item(s) is/are managed by your service.

NSN	PART NUMBER	ACTIVITY CODE
5962 01 375 0373	CS1905AT	TD

2. Deadline for placement of orders is 1 November 2001. Recommend that your Service contact Cypress Semiconductor, 3901 North First Street, San Jose, CA 95134-1599, phone (408) 943-2600 for guidance on what actions may be appropriate.

Appendix H. Initial Alert Notification

From: Peyton Robert DSCC/CCD

To: All DMSMS POCs

Subject: Initial Alert for DMSMS Case Number 01-123

1. This Center has been advised by Cypress Semiconductor (CAGE 65786), the only known source that production of the NSNs listed below / as enclosure will cease after the next procurement.

NSN	PART NR	WEAPONS APPL
5962 01 123 1234	CY2147-55PC	RADAR, FIREFINDER AN/TPQ37
5962 01 123 1235	CY2147-56AB	AIRCRAFT, STRATOLINER C-135
		PAVE PHASED ARRAY WARN SYS
		AIRCRAFT, B-1B
		SEAWOLF CLASS SSN
5962 01 123 1236	CY2147-66BT	AIRCRAFT, AWACS, E-3A

2. To prevent the above discontinuance from jeopardizing mission support, request you review your extended support requirements for submission to this Center. The following types of requirements should be considered:

a. Normal replenishment/replacement requirements.

b. War Reserve requirements.

c. Government furnished Materiel requirements

d. Retrofit and overhaul requirements. (note: users are encourages to exclude these devices whenever possible from new design or redesign of existing equipment)

3. Request you provide, no later than 1 November 2001, the following:

a. The quantity required for extended support of the equipment and the number of years support that quantity represents. In your reply, request inclusion of a statement of necessity for national security which may be required to authorize/justify stockage of materiel beyond normal levels. (Not applicable for International Logistics (IL) customers)

b. Submission not later than 1 Nov 2001, of funded requisitions from International Logistics customers for life-of-type requirements. Requisitions submitted under any type Foreign Military Sales (FMS) case, e.g., defined line, blanket open end, or cooperative logistics supply support agreement, are acceptable. Cite advice code 2L or equivalent on the requisition.

c. Funded MIPRs for hardware to be acquired for subsequent use in production of new higher assemblies (i.e., throw away modules/new end items which may be planned/programmed)

4. Justification may be required where your quantity and/or support period projections significantly exceed DSCC estimates. Also, failure to respond with projections with projections by 1 November 2001 will result in non-support for your Service/Agency.

5. This Center is continuing its research for alternate sources. However, due to limited time requirements determination, this DMSMS announcement is being made prior to completing research.

6. Request you reference this e-mail and DMSMS case number 01-123 in your reply.

7. Point of contact at this center is Mr. Robert Peyton, DSCC-CCD, DSN 850-2387, commercial (614) 692-2387.

Appendix I. Requirements Spreadsheet

DATE: IM: SECT: ORC: EXT:

LINE	ORC	NSN	WEAP CODE WISC	QFD	A. 2 YR LEVEL (QFDx8)	B/O	SOH	(EXCLUDE ARE QTY) DUE-IN PR	CONT	A. Shortage SHRTGE TO 2 YR LEVEL (BUY QTY)	ACQ U/C	TOTAL DOLLAR
	M.L	5962										
1		01 102 3840		154	1232	0	364	0	0	868	3.96	3437.28
2	BASIS FOR BUY (indicate one only)	DMS CERT NOT REQD →								868		3437.28

LINE	ORC	NSN	WEAP CODE WISC	QFD	A. 2 YR LEVEL (QFDx8)	B/O	SOH	(EXCLUDE ARE QTY) DUE-IN PR	CONT	A. Shortage SHRTGE TO 2 YR LEVEL (BUY QTY)	ACQ U/C	TOTAL DOLLAR
	ML	5962										
1		01 138 3156		12	96	0	36	0	0	60	6.99	419.40
2	BASIS FOR BUY (indicate one only)	DMS CERT NOT REQD →								60		419.40

LINE	ORC	NSN	WEAP CODE WISC	QFD	A. 2 YR LEVEL (QFDx8)	B/O	SOH	(EXCLUDE ARE QTY) DUE-IN PR	CONT	A. Shortage SHRTGE TO 2 YR LEVEL (BUY QTY)	ACQ U/C	TOTAL DOLLAR
	MD	5962										
1		01 283 4317		19	152	0	82	0	0	70	21.00	1470.00
2	BASIS FOR BUY (indicate one only)	DMS CERT NOT REQD →								70		1470.00

LINE	ORC	NSN	WEAP CODE WISC	QFD	A. 2 YR LEVEL (QFDx8)	B/O	SOH	(EXCLUDE ARE QTY) DUE-IN PR	CONT	A. Shortage SHRTGE TO 2 YR LEVEL (BUY QTY)	ACQ U/C	TOTAL DOLLAR
		5962										
1		01 099 8506		25	200	0	1144	0	0	Ø	4.16	Ø
2	BASIS FOR BUY (indicate one only)	DMS CERT NOT REQD →								Ø		Ø

LINE	ORC	NSN	WEAP CODE WISC	QFD	A. 2 YR LEVEL (QFDx8)	B/O	SOH	(EXCLUDE ARE QTY) DUE-IN PR	CONT	A. Shortage SHRTGE TO 2 YR LEVEL (BUY QTY)	ACQ U/C	TOTAL DOLLAR
	MD	5962										
1		01 225 1556		15	120	0	68	0	0	52	10.95	569.40
2	BASIS FOR BUY (indicate one only)	DMS CERT NOT REQD →								52		569.40

1. Complete entire line 1. (Note that B. will initially be 0)

2. Compare A. and B. Select the larger as the "Basis for Buy" and record the applicable A.shortage or B.shortage in line 2.

3. As Service forecasts are received, record in appropriate spaces ofline 1 and recompute entire line 1 (i.e., both A and B). Be sure to exclude any "ARE" quantity from the due-in figures.

DMS CASE:
MANUFACTURER: DMS 01-164 / Texas Instruments (d: 31 Dec 01)

SERVICE RESPONSE FORECASTS									B.					B. Shortage			
A	AF	M	N	NBA	CG	FAA	NASA	OTER	TOTAL SVC REQMT	B/O	SOH	EXCLUDE ARE QTY DUE-IN PR	CONT	SHRTGE TO TOT SVC REQMT (BUY QTY)	ACQ U/C	TOTAL BUY COST	
															3.14		PR # (ARE)
DMS CERTIFICATION REQUIRED →																	01 331 5oo 002

SERVICE RESPONSE FORECASTS									B.					B. Shortage			
A	AF	M	N	NSA	CG	FAA	NASA	OTHR	TOTAL SVC REQMT	B/O	SOH	EXCLUDE ARE QTY DUE-IN PR	CONT	SHRTGE TO TOT SVC REQMT (BUY QTY)	ACQ U/C	TOTAL BUY COST	
																	PR # (ARE)
DMS CERTIFICATION REQUIRED →																	01 331 5oo 003

SERVICE RESPONSE FORECASTS									B.					B. Shortage			
A	AF	M	N	NSA	CG	FAA	NASA	OTHR	TOTAL SVC REQMT	B/O	SOH	EXCLUDE ARE QTY DUE-IN PR	CONT	SHRTGE TO TOT SVC REQMT (BUY QTY)	ACQ U/C	TOTAL BUY COST	
																	PR # (ARE)
DMS CERTIFICATION REQUIRED →																	01 331 5oo 004

SERVICE RESPONSE FORECASTS									B.					B. Shortage			
A	AF	M	N	NSA	CG	FAA	NASA	OTHR	TOTAL SVC REQMT	B/O	SOH	EXCLUDE ARE QTY DUE-IN PR	CONT	SHRTGE TO TOT SVC REQMT (BUY QTY)	ACQ U/C	TOTAL BUY COST	
																	PR # (ARE)
DMS CERTIFICATION REQUIRED →																	

SERVICE RESPONSE FORECASTS									B.					B. Shortage			
A	AF	M	N	NSA	CG	FAA	NASA	OTHR	TOTAL SVC REQMT	B/O	SOH	EXCLUDE ARE QTY DUE-IN PR	CONT	SHRTGE TO TOT SVC REQMT (BUY QTY)	ACQ U/C	TOTAL BUY COST	
																	PR # (ARE)
DMS CERTIFICATION REQUIRED →																	01 331 5oo 005

4. Each time line 1 is recomputed, (as in step 3) select the larger of A and B as the "Basis for Buy" and record the applicable A.shortage or B.shortage in line 2.

5. Determine from line 2 whether or not a DMS Certification is required.

This spread sheet contains replenishment NSNs only. or NSO items having Mil SVC forecasted reqmts.

Appendix J. DMS Manual Purchase Request

PR NUMBER: ARE 01123 000 100

NSN: 5962010144958

ITEM NAME: Microcircuit

FCC: A

PR LINE NUMBER: 000100 305 ea

PARCEL POST / FREIGHT ADDRESS:
DEFENSE DISTRIBUTION REGION WEST (W62G2T)
MF SC0900 STOCK
TRANSPORTATION OFC BLDG 330 CRP
LANTHROP, CA 95330

RDD: 01365 PROJ: DMS

PREP FOR DELIVERY: SEE DSCC FORM 289C ATTACHED

END OF PR

Appendix K. Validation Request

From: Peyton Robert DSCC/CCD

To: DMSMS POC

Subject: DMSMS Case Number 01-123, Validation Request

1. Reference faxed copy of your DMSMS letter dated 21 October 2001.

2. Referenced letter included some large requirements which have little or no demand history to substantiate the forecasts. Specifically, they are:

NSN	YRS	QTY	@STD U/C	= TOTAL $	SIGNATURE LVL
5962 01 307 2589	15	3	$33152	$99K	not specified
5962 01 314 4870	15	87	$3914	$340K	Division
5962 01 314 9712	15	420	$895	$376K	Division
5962 01 314 9740	15	107	$786	$84K	not specified
5962 01 314 9741	15	235	$1392	$327K	Division

3. Please provide detailed justification showing how requirements were computed, how support has been provided to date, and when anticipated demands will commence. Please note the required signature level for the higher dollar buys. Request you provide justification to this office. If you have questions, please contact Mr. Robert Peyton, DSCC-CCD, DSN 850-2387, commercial (614) 692-2387.

Appendix L. GEM Checklist

GEM

Generalized Emulation of Microcircuits

CHECKLIST

NSN:
Purchase Request Number:
Purchase Request Quantity:
Controlling P/N Reference:

WEAPONS CRITICAL	☐ YES	☐ NO
DIGITAL LOGIC	☐ YES	☐ NO
SUPPLY VOLTAGE < / = **20 VOLTS**	☐ YES	☐ NO
Package < / = **48 Pins**	☐ YES	☐ NO
DATA AVAILABLE	☐ YES	☐ NO
PURCHASE REQUEST	☐ OPEN	☐ CLOSED

COMMENTS:

NAME:	DATE:

Appendix M. DMS Certification Document

FROM: DSCC-CCD

MEMORANDUM FOR DSCC-C

SUBJECT: DMS Certification (Approval of Total Buy Package for Case 01-123)

1. In August 2001, Cypress Semiconductor, the only known source, announced that it would discontinue production of certain products. Last time orders were to be accepted through 1 November 2001. No other manufacturer has shown interest in supplying these products.

2. Military Service and Agency DMS focal points were contacted regarding this discontinuance and their life-of-type system support requirements were solicited. The Navy and Air Force provided long term system support requirements.

3. Extended buys were computed using user forecast data. The total buy package includes 4 items having a total dollar value of $150,420. No individual PR has a dollar value greater than $100K.

4. Pursuant to authority granted in the National Defense Authorization Act and in the interest of national security, it is recommended that this buy package be approved.

5. Point of contact regarding this matter is Mr. Robert Peyton, DSCC-CCD, extension 2-2387.

Chief, (Division)

Approved_____ Disapproved_____

Director, Commodities

Appendix N. Original Integrated Policy Memorandum

DEFENSE LOGISTICS AGENCY
DEFENSE SUPPLY CENTER, COLUMBUS
POST OFFICE BOX 3990
COLUMBUS, OH 43216-5000

IN REPLY
REFER TO

INTEGRATED POLICY MEMORANDUM (IPM) April 6, 1998
NO. 97-0003A

DIMINISHING MANUFACTURING SOURCES AND MATERIEL SHORTAGES (DMSMS) PROGRAM

I. REFERENCES:

A. DoD 4140.1, Materiel Management Policy.

B. DoD 5000.2-M, Defense Acquisition Management Policies and Procedures.

C. DLAR 4005.6, Diminishing Manufacturing Sources and Materiel Shortages (DMSMS) Program.

D. DLAR 4155.37 Materiel Quality Control Storage Standards.

E. DESC Supply Operations Procedure 92-20, July 14, 1992, Certification Statement for all DMSMS buys.

II. PURPOSE AND SCOPE:

The purpose of this IPM is to define policy and procedures for Defense Supply Center Columbus (DSCC). This IPM applies to DSCC-A, -B, -C, -L, -M, -R, -V, and -DU.

III. SIGNIFICANT CHANGES:

This IPM has been significantly revised and should be read in its entirety.

IV. DEFINITIONS:

A. Diminishing Manufacturing Sources and Materiel Shortages (DMSMS). Is a condition brought about when the last known manufacturer announces the intention to

discontinue production of an item, group of items, entire production line, or even an entire production facility producing items still required by Department of Defense (DoD) activities for systems support. DMSMS can thus directly affect readiness and sustainability of the armed forces (and non-DoD federal agencies). In particular, weapon systems can be impacted at any point in their life cycles.

B. Life-of-Type (LOT) Buy. A LOT Buy is an acquisition for the estimated, aggregate future demand of a DMSMS item. If other solutions are not available and a LOT buy is required, customer input is critical. Existing law makes LOT buys impossible unless they can be justified on the basis of "national security". It should be noted that although not the preferred option, a LOT buy can provide a very cost effective solution to a DMSMS problem, but only if the customers provide timely responses to our requirements inquiry messages. LOT buys normally cover requirements for spares and maintenance. Though we will procure parts for new production; such buys must be funded by the Service funding the production.

V. BACKGROUND:

A. DMSMS alternatives/solutions when there is not sufficient stock on hand or due in to support projected out-year requirements:

1. Encourage the existing source to continue production.

2. Find another source. A smaller company might undertake production that no longer is profitable for a larger company.

3. Obtain an existing substitute item that will perform fully (in terms of form, fit, and function) in place of the DMSMS item.

4. Obtain an existing substitute item that, while it would satisfy one or more functions, might not necessarily perform satisfactorily in all of them (conditional substitute).

5. Redefine Military Specification (MIL-SPEC) requirements through appropriate engineering support activities, and consider buying from a commercial source. This may include MIL-SPEC tailoring. Such a course of action might induce the emergence of additional sources.

6. Use current manufacturing processes to produce a substitute item (form, fit, function) for the unobtainable item. This emulation type technology is particularly useful in producing microcircuits. Through microcircuit emulation, inventory reduction can be achieved as obsolete items can be replaced with state-of-the-art devices which can be manufactured and supplied on demand. Emulation may be considered a more preferred alternative to 3. And 4. Above, if the part may be used in a wide variety of functions.

B. Additional terms and definitions applicable to the DMSMS Program can be found in DoD 4140.1- R, appendix L.

VI. POLICY:

The thrust of DSCC's DMSMS Program is to assure ongoing availability of electronic/construction parts to all customers, including Foreign Military Services (FMS), irrespective of their availability in the marketplace and to provide this service as cost effectively as possible. DSCC becomes aware of a DMSMS situation through manufacturer notifications, Government Industry Data Exchange Program (GIDEP), and from a variety of sources in the DoD. Any determination of the best course to follow is influenced by customer input and cost considerations. The military services have at their disposal other options as well, such as redesign and reclamation.

VII. RESPONSIBILITIES:

A. The Director, DSCC-C, will provide for and staff DSCC-CD.

B. The Chief, DSCC-CD will:

1. Manage the DMSMS Program.

2. Maintain liaison with all affected DSCC organizational elements.

3. Perform all contracting functions associated with DMSMS cases.

4. In collaboration with Commodity Management Group (CMG) and Application Group (AG) DMSMS coordinators, establish an acquisition planning document outlining the processing/action milestones for each case. This document will be the basis for establishing goals/priorities in the processing of DMSMS spreadsheets, Purchase Requests (PRs), and contracting actions.

5. Maintain accountability and review progress of each DMSMS item/case and provide written reports as necessary. In this regard, progress review meetings will be held as necessary.

6. Provide to higher management/HQ DLA, DMSMS Program data, status of DMSMS cases, and other information as necessary. Develop data, tracking, and charting techniques for portraying program status.

7. Track status/progress of each item throughout the DMSMS process.

8. Provide input to the Government Industry Data Exchange (GIDEP) DMSMS database.

9. Maintain a central file record on each DMSMS case initiated.

10. Ensure that PRs are processed in accordance with acquisition planning document milestones.

11. Bring to the attention of DSCC-C Director any issue that cannot be resolved by DSCC-CD.

12. Continuously assess the effectiveness of the DMSMS Program and take/recommend corrective action as appropriate.

13. To be the DSCC central focal point on DMSMS matters requiring interface with outside activities such as HQ DLA, DoD, the Military Services (herinafter referred to as the Services) (including Service DMSMS Focal Points), suppliers, and industry associations. Serve as the DSCC representative on the DLA DMSMS Working Group, DoD DMSMS Steering Group, and similar groups.

14. Provide briefings to the Commander/Deputy Commander (DSCC-D/DD) and DSCC staff on program status as required.

15. Provide internal and external briefings on the DMSMS Program.

16. Provide DMSM Program training to other organizational elements as necessary.

17. Maintain liaison with the Generalized Emulation of Microcircuits (GEM) Program Office (DSCC-VSC) on DMSMS items in Federal Supply Class (FSC) 5962 and consider the GEM Programs capabilities in formulating a case solution.

C. The Directors/Chiefs, AGs/CMGs, DSCC-A, C, L, M, will:

1. Designate a DMSMS coordinator within the CMG/AG to act as the primary interface with DSCC-CD on DMSMS matters.

2. As provided by DSCC-CD, advise CMG/AG personnel of policy, procedures, etc., for processing DMSMS cases.

3. Perform all inventory management functions associated with DMSMS items.

4. Perform all technical functions associated with DMSMS items.

5. Perform all assigned quality assurance functions associated with DMSMS items.

D. The Director, DSCC-B, will provide support to the DMSMS Program through system analysis and development and policy support.

E. The Chief Financial Officer/Budget, DSCC-R, will, through the budgeting process, ensure that budget submissions include funding for those alternatives selected as solutions to DMSMS supply support problems and be responsible for requesting supplemental funds in addition to those forecasted.

F. The Director, DSCC-V, will:

1. Ascertain the state-of-the-art for electronics piece parts, specifications, and qualification impact and, through GIDEP and the Military Parts Control Program, alert military system designers to the existence of DMSMS items.

2. Develop packaging criteria and, in conjunction with CMGs/AGs, determine long-term storage requirements as necessary.

3. Ensure, to the maximum extent practical through parts screening for potential technology obsolescence, that identified DMSMS items are not included in DoD systems during design, redesign, or production.

G. The Defense Logistics Agency Office of Council for the Columbus Region (DOCCR), will provide legal guidance necessary to the resolution of DMSMS cases and related subjects.

H. The Director, DSCC-P, will, as required, provide contractual review and guidance, contractor performance information, as well as information received concerning manufacturing discontinuance of an item or entire production line.

I. The Associate Director, DSCC-DU, will coordinate with DSCC-CD contracting personnel, as appropriate, to attempt to locate alternate sources of supply.

VIII. PROCEDURES:

A. CMG/AG Contracting personnel will:

1. Report contracting information received concerning manufacturing discontinuance of an item or entire product line to DSCC-CD.

2. Coordinate with DSCC-CD regarding disposition of purchase requests (PRs) in process in the CMG/AG that are affected by the discontinuance.

B. CMG/AG Technical Personnel will:

1. Identify technical part number and/or national stock number (NSN) family relationships that may exist.

2. Initiate a technical spreadsheet, within established milestones, that will provide the following information:

a. National Stock Number (NSN).

b. Part number.

c. Primary reference..

d. Primary Inventory Control Activity (PICA).

e. Continuing alternate source(s).

f. Duplicate DMSMS cases.

3. Review DMSMS items for interchangeablility, substitutability, alternate sources of supply, or other means of support.

4. Coordinate potential alternate items/sources with the Services' Engineering Support Activity (ESA), as required.

5. Coordinate/expedite standardization actions with the Services as required.

6. Receive DMSMS PRs from DSCC-CD where all sources have no bid.

a. Upon receipt of this information, the equipment specialist will review and determine the appropriate action i.e. further processing or cancellation.

b. Advise DSCC-CD of recommendation.

7. Review for other potential sources when a DMSMS rebuy PR is received.

C. Packaging specialists, DSCC-VSP, will:

1. Develop packaging criteria as required.

2. Determine long-term storage requirements for FSC 5962.

3. Monitor the DMSMS long-term dry nitrogen storage facility at Hill Air Force Base for compliance with storage procedures and practices involving DSCC managed FSC 5962 devices.

D. CMG/AG Inventory Management Personnel will:

1. Upon receipt of the technical spreadsheet, ascertain the existing asset position to determine the potential for future stock shortage. Provide DSCC-CD, within established milestones, an initial requirements spreadsheet which contain all NSNs identified on technical spreadsheet. Compute for each replenishment NSN a 2-year requirement, indicating a stock shortages if appropriate. No computation is necessary for all non-replenishment NSNs since they will only be procured if customer projections are received.

2. Provide special DMSMS transaction history file printouts of affected NSNs to the Services.

3. Based on customer responses, provided by DSCC-CD, determine life-of-type buy quantities for applicable NSNs and initiate PR's within established milestones. In the absence of customer response, PR's may be initiated for 2-year shortages.

4. Provide DSCC-CD a final requirements spreadsheet incorporating customer projections.

5. As necessary, validate customer requirements projections when they appear to be in conflict with demand history.

6. Obtain detailed justification (showing computations) for all projections that result in buys over $100,000. For projections over $100,000 but less than $500,000 require the originator to provide a letter signed out at Division Level or higher. Projections resulting in buys of over $500,000 require the originator to provide a letter signed out at Directorate Level or higher.

E. CMG/AG Quality Assurance Personnel will:

1. Review all DMSMS items for applicability of quality requirements.

2. Review for contractor quality history.

3. Coordinate shelf life requirements, if applicable with DSCC-V.

F. DSCC-CD Contracting Personnel will:

1. Review all notifications of product discontinuance received from such sources as CMG/AG buyers, contractors, GIDEP, Navy DMS Technical Center, Services, commercial publications, etc.

2. Communicate with the contractor to obtain details regarding the proposed discontinuance (i.e. final production run, residual stock, surplus materiel, part numbers,

NSNs, nomenclature, final order deadline, minimum order quantity, available drawings) and attempt to persuade the contractor to maintain production.

3. Verify alternate sources to include those identified by the appropriate CMG/AG personnel.

4. Negotiate extension of unreasonable final order deadlines (as necessary, to provide adequate DoD response time).

5. Develop a DMSMS Planning Document, including milestones for each DMSMS case. When developing the Planning Document, take into account both the estimated contract cost and contractor deadline date.

6. Process PR's resulting from 2-year or life-of-type buys and monitor awards to completion.

7. Forward DMSMS PR's receiving no bids from all sources to CMG/AG technical personnel for review and recommended action.

8. In conjunction with the CMG/AG DMSMS focal point, monitor receipt discrepancies so as to effect timely resolution.

G. DSCC-CD Technical Liaison Personnel will:

1. Provide procedural guidance in matters concerning DMSMS case processing to equipment specialists located in the CMG/AG.

2. Interact with CMG/AG DMSMS coordinators, customers, vendors and other directorates to resolve problems.

3. Receive and control incoming and outgoing correspondence requiring technical review and evaluation.

4. Provide contractor discontinuance notifications to GIDEP.

5. Download and review GIDEP notices to ensure that all DSCC managed items have a DMSMS case assigned.

6. Review all incoming contractor discontinuance notifications for prior DMSMS case number assignment and review prior to forwarding to CMG/AG. Provide results of review to CMG/AG for each NSN i.e. sources identified, substitutes, and indicate if a DMSMS buy was made and the date of the buy.

7. Request DMSMS item manufacturer to provide data.

8. Check option C of the CTDF to determine involvement of the Value Management Program Unit or the Flexible Computer Integrated Manufacturing Office (FCIM) and inquire if a possible continuing source is indicated.

9. Assist equipment specialists with DMSMS case processing as required.

10. In cooperation with CMG/AG DMSMS coordinators, assign milestones for technical spreadsheets.

11. Monitor CMG/AG adherence to milestones for technical spreadsheets and follow up with CG/AG coordinators as necessary.

H. DSCC-CD Inventory Management Liaison Personnel will:

1. Assign DMSMS case numbers.

2. Assign milestones for requirements spreadsheets and PR's.

3. Monitor CMG/AG item manager (IM) adherence to milestones and follow-up with CMG/AG coordinators as necessary.

4. Review/check IM spreadsheets and PR's for conformance to policy.

5. Provide procedural guidance in matters concerning DMSMS case processing to IM's located in the CMG's/AG's.

6. Maintain the DMSMS Master File and review problems/violations related to associated reports/actions.

7. Support special requirements related to DMSMS program management and execution.

8. Interact with CMG/AG coordinators to resolve problems.

9. Assist IM's with DMSMS case processing as required.

10. Notify military service and other customers of discontinued DSCC managed DMSMS parts which are sole source and request requirements projections by an established milestone date.

11. Notify the Services or Civil Agencies when NSN's managed by them are included in a discontinuance notice.

12. Control incoming and outgoing correspondence requiring IM review and evaluation.

I. The Director, DSCC-V, will:

1. Provide engineering support by reviewing DMSMS items for alternate sources/item(s) as requested by DSCC-CD, CMG's/AG's.

2. Review DMSMS FSC 5962 (microcircuits) item(s) to determine if they are candidates for the Generalized Emulation of Microcircuits (GEM) Program.

3. Review DMSMS item(s) to determine if they had been recommended for new design and issue a MPCAG Alarm as needed.

4. Where appropriate, enter DMSMS item(s) into the GIDEP information system.

5. As necessary, inform DSCC-CD of manufacturer's planned obsolescence.

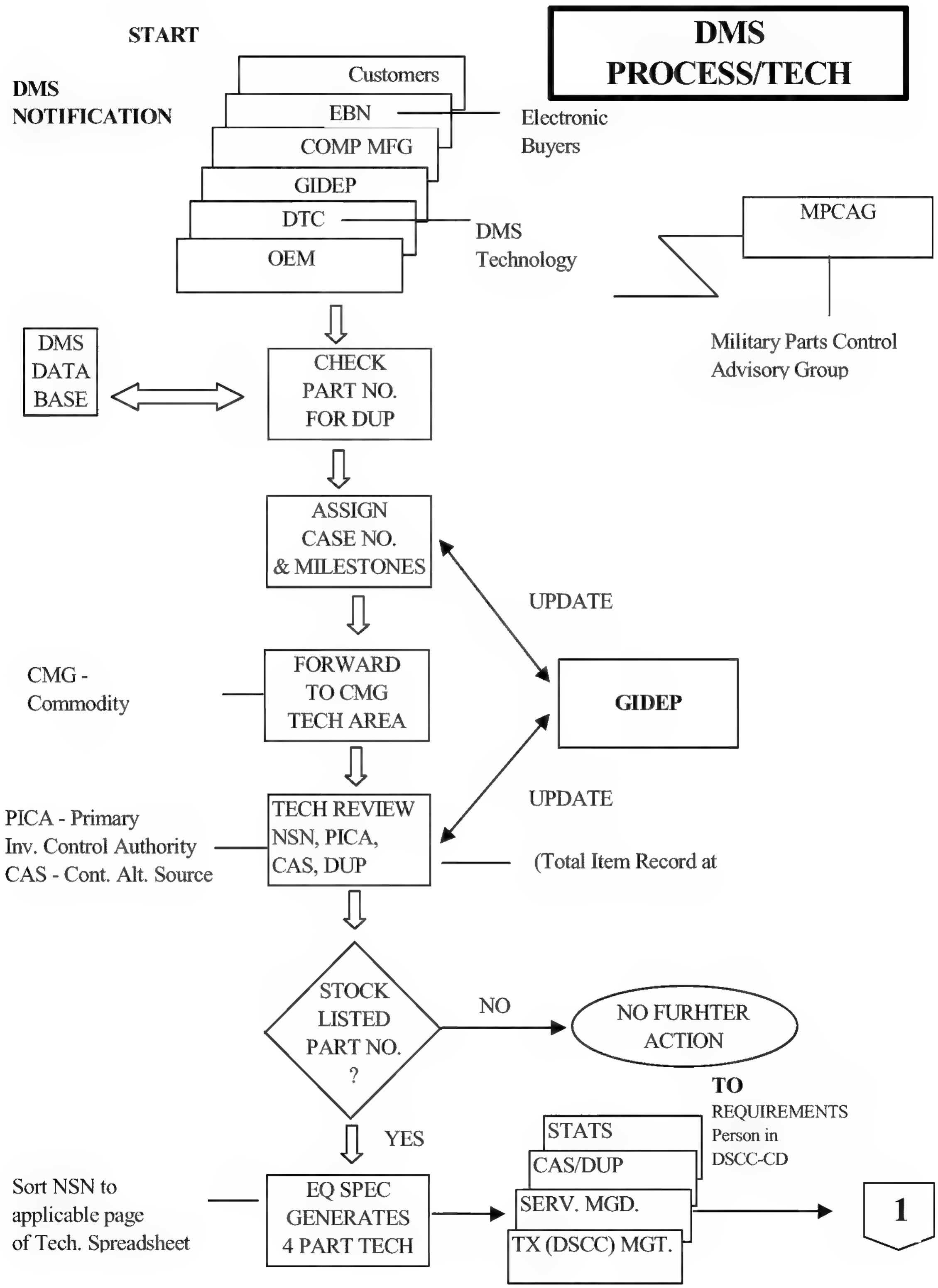
IX. APPROVAL AUTHORITY:

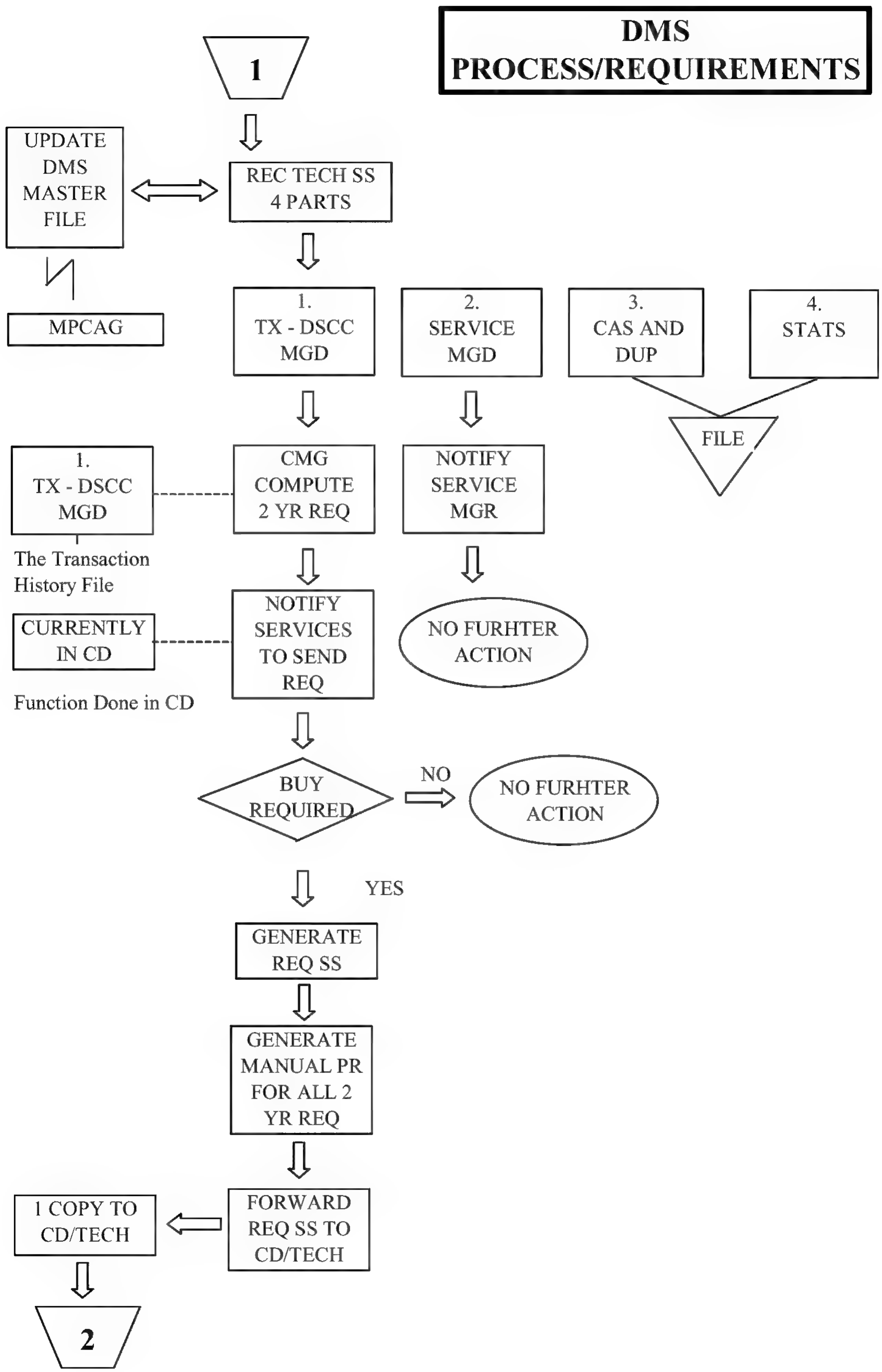
A DMSMS Certification is required for all DMSMS buys exceeding two years of demand. DMSMS Certification packages will be forwarded through DSCC-CD, to the applicable Director of C/ AG's to DSCC-D when the dollar value of the buy(s) exceed $850,000. This value applies for a single NSN or a group of NSN's since DMSMS cases often involve concurrent buys for multiple NSN's. Authority for approval of DMSMS certification of DMSMS buys for less than $850,000 will reside with the directors of CMG's/AG's.

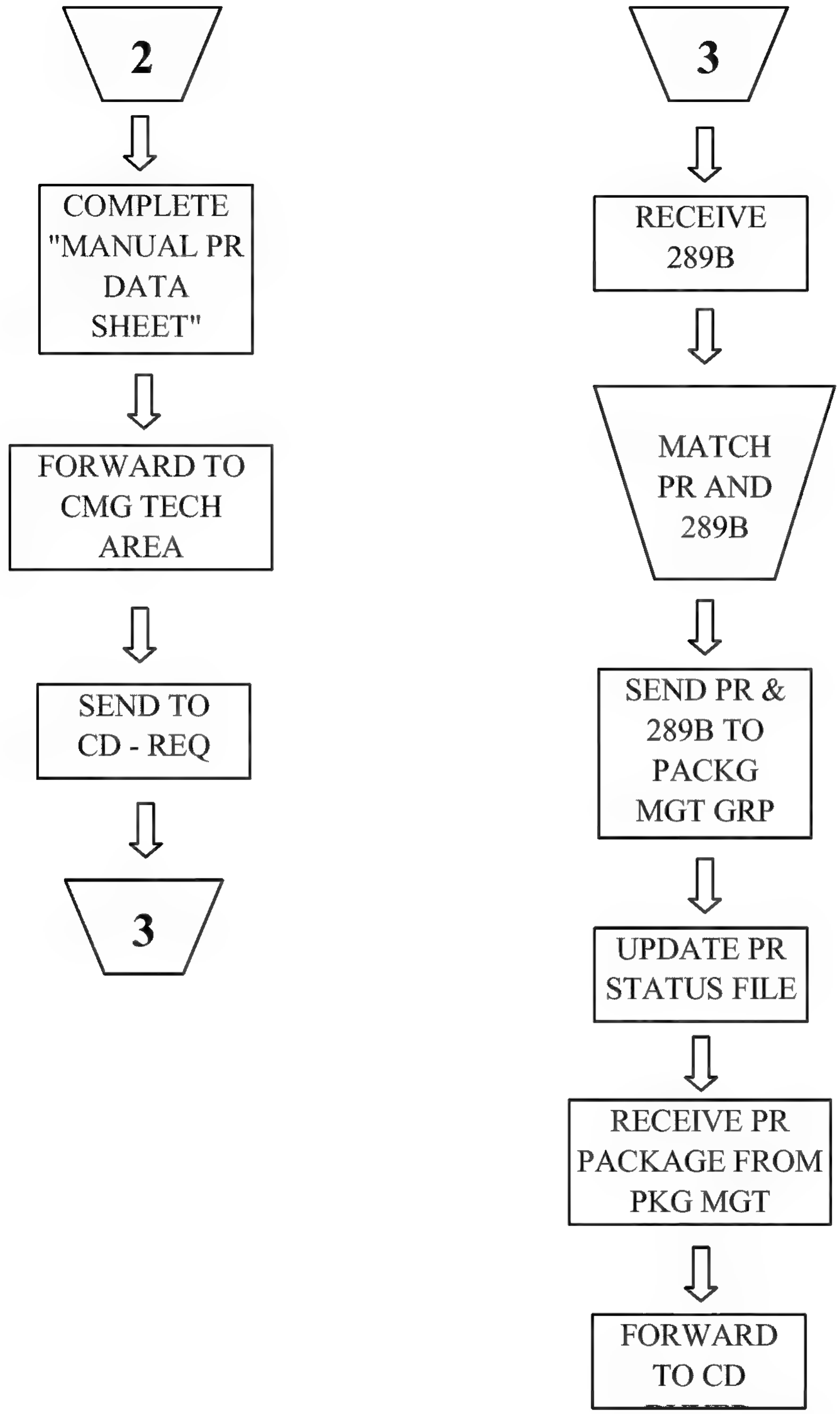
/S/
PAUL D. VICARS
Director, Directorate of Corporate Information

Distribution
MIS1

Appendix O. Original Process Flowchart




DMS PROCESS/REQUIREMENTS
1
UPDATE DMS MASTER FILE
REC TECH SS 4 PARTS
MPCAG
1. TX - DSCC MGD
2. SERVICE MGD
3. CAS AND DUP
4. STATS
FILE
1. TX - DSCC MGD
The Transaction History File
CMG COMPUTE 2 YR REQ
NOTIFY SERVICE MGR
CURRENTLY IN CD
Function Done in CD
NOTIFY SERVICES TO SEND REQ
NO FURHTER ACTION
BUY REQUIRED
NO
NO FURHTER ACTION
YES
GENERATE REQ SS
GENERATE MANUAL PR FOR ALL 2 YR REQ
FORWARD REQ SS TO CD/TECH
1 COPY TO CD/TECH
2


2
COMPLETE "MANUAL PR DATA SHEET"
FORWARD TO CMG TECH AREA
SEND TO CD - REQ
3
3
RECEIVE 289B
MATCH PR AND 289B
SEND PR & 289B TO PACKG MGT GRP
UPDATE PR STATUS FILE
RECEIVE PR PACKAGE FROM PKG MGT
FORWARD TO CD

Appendix P. New DMSMS Office Guidance

19 Dec 01

DSCC SUPPLEMENT TO
DLA REGULATION
NO. 4005.6

DIMINISHING MANUFACTURING SOURCES AND MATERIAEL SHORTAGES (DMSMS) PROGRAM

I. REFERENCES

A. DoD 4140.1-R. *DoD Materiel Management Regulation.*

B. DoD 5000.2-M, *Defense Acquisition Management Policies and Procedures.*

C. DLAR 4005.6, *Diminishing Manufacturing Sources and Materiel Shortages (DMSMS) Program.*

D. DLAR 4155.37, *Materiel Quality Control Storage Standards.*

E. DESC Supply Operations Procedure 92-20, July 14, 1992, Certification Statement for all DMSMS buys.

II. PURPOSE AND SCOPE

This supplement to DLAR 4005.6 is to be used as a guide in the implementation of the DSCC DMSMS Program. The goal of the DSCC DMSMS Office is to assure the availability of DSCC-managed items irrespective of their availability in the marketplace.

III. POLICY

DSCC will take timely action to mitigate the impact a DMSMS situation will have on acquisitions and logistics support. The DSCC DMSMS Office has been established in accordance with DoD 5000.2-M, part 5 section E, and part 6 section 6. The DMSMS management strategy used by DSCC is derived from DoD 4140.1-R chapter 1.4.

IV. DEFINITION

Diminishing Manufacturing Sources and Material Shortages (DMSMS) is the loss, or impending loss, of the last known manufacturer or supplier of an item or the shortage of raw materials needed to support a weapon system. DMSMS can happen at any time in the life cycle of a system, from design to operations and support, jeopardizing readiness

and drastically increasing total ownership costs. DMSMS is not limited to individual items or parts. It can affect weapon systems at any level of indenture.

V. BACKGROUND

DSCC will incorporate each of the DMSMS solutions described in DoD 4140.1-R. Listed below are the definitions of the applicable DoD DMSMS resolution alternatives in order of preference. Additional DMSMS terms and definitions can be found in DoD 4140.1-R.

A. Encourage Existing Source. Encouraging the existing source to continue production is the preferred method of resolving a DMSMS issue. In the main, there are two types of encouragement: price incentives and quantity guarantees.

B. Find Another Source. One company may be willing to produce a product that is not profitable for another company. When considering the use of another source, like an aftermarket manufacturer, the analyst must ensure that the company has the capability to meet the original item specification requirements. Although its use is not mandated by DSCC, the Qualified Manufacturers List (QML) may offer the best solution. The QML is a listing of facilities that have been evaluated and determined to be acceptable based on the testing and approval of a sample specimen and conformance to the applicable [product] specification. A replacement item selected from a vendor on the QML may be acceptable as-is and require no further testing.

C. Substitute. Substitution involves finding a similar item that meets the Form, Fit, Function, and Interface (F^3I) of the DMSMS item.

D. Limited Substitute. A limited substitute is an item that does not fully meet the form, fit, and function of the DMSMS item.

E. Redefine Military Specifications. Redefine a military specification (MIL-SPEC) item through the respective Engineering Support Activity (ESA) and consider buying a replacement item from a commercial source. This is commonly referred to as selecting a Commercial-Off-The-Shelf (COTS) item.

F. Produce a Substitute Item (Form, Fit, Function). Use current manufacturing processes to produce a substitute item with the same form, fit, and function of the DMSMS item.

G. Bridge Buy. A bridge buy is a temporary measure that provides sufficient time to develop one of the other solutions.

H. Life-of-Type (LOT) Buy. Life-of-Type (LOT) buys are placed using the aggregated demand for an item through the estimated remaining life of the system.

VI. SIGNIFICANT UPDATES

This supplement to DLAR 4005.6 has been significantly revised and should be read in its entirety.

VII. RESPONSIBILITIES

A. The Commander, DSCC will:

1. Develop and implement the procedures outlined in DoD 4140.1-R.
2. Appoint DMSMS Program Manager.
3. Ensure DMSMS items held in inventory are reviewed annually.
4. Ensure items held in inventory are stored in accordance with DLAR 4155.37.
5. Sign DMSMS documentation when necessary.

B. The Director, DSCC-C will:

1. Provide for and staff DSCC-CCD.
2. Sign DMSMS documentation when necessary.

C. The Chief, DSCC-CCD will:

1. Manage the DSCC DMSMS and GEM Program.
2. Maintain liaison with all affected DSCC organizational elements.
3. Maintain accountability of DMSMS cases.
4. Provide DMSMS case data to higher management.
5. Ensure GIDEP is utilized and updated as necessary.
6. Function as the DSCC DMSMS focal point.
7. Represent DSCC on the DLA DMSMS Working Group, DoD DMSMS Steering Group, and other groups as necessary.

VIII. PROCEDURES

The DSCC DMSMS management structure is listed in Appendix A. The organizational chart lists the many specialties within the DSCC DMSMS Office. These specialties are program management, systems analyst, contracting, engineering, system administrator, supply system analyst, and equipment specialists. Appendix B depicts the DMSMS Office as a system with inputs and outputs. The functional areas below, as depicted in Appendix C, work to convert the primary input, discontinuance notices, into a primary output, a DMSMS solution.

A. The System Administrator will:

1. Obtain/receive the discontinuance notice.
2. Ensure discontinuance notice is not a duplicate.

3. File duplicate notice with existing case documentation.

4. Review notice with team members and note any details requiring clarification.
5. Assign a DMSMS case number based on the last time buy (LTB) date. If date has past or is within XX days, work with manufacturer to extend LTB date.
6. Meet with DMSMS Office to assign the case to an engineer and establish milestones.
7. Enter/monitor milestones into database.
8. Update GIDEP as necessary.

1. The Engineer will:

    1. Build Technical Spreadsheet (TS) (see Appendix D) to include case number, national stock number, part number, primary reference, primary inventory control authority (PICA), duplicate or continuing approved source, and notes.
    2. Gather data for the TS. The following is a partial list of resources: Federal Logistics (FEDLOG) system, Federal Logistics Information System (FLIS), Total Item Record, Haystack, PartMiner, Standard Microcircuit Cross-Reference (QPL/QML), Shared Data Warehouse (SDW), and DoD DMSMS Teaming Database.
    3. Determine if the item is stock listed:
        a. If yes, continue to step 4.
        b. If no, no further action is required.
    4. Determine if the item is managed by DSCC:
        a. If yes, continue to step 5.
        b. If no, update TS with PICA.
    5. Send TS to the Management Assistant for input into the SDW and the DMS Database.
    6. Notify Provisioning Engineers of item discontinuance.
    7. Review for alternate source or substitute.
    8. Determine if item has been emulated before:
        a. If yes, continue to step 9.
        b. If no, proceed to step 10.
    9. Ensure die are available.
    10. Determine if the weapon system is critical:
        a. If yes, coordinate alternatives with Engineering Support Agency (ESA) and complete TS and DSCC Form 289C (see Appendix E).
        b. If no, complete TS and DSCC Form 289C.
    11. Forward the completed TS to the Supply System Analyst, the Management Assistant, and the System Administrator.

2. The Management Assistant will update the DMS database and the SDW as necessary.

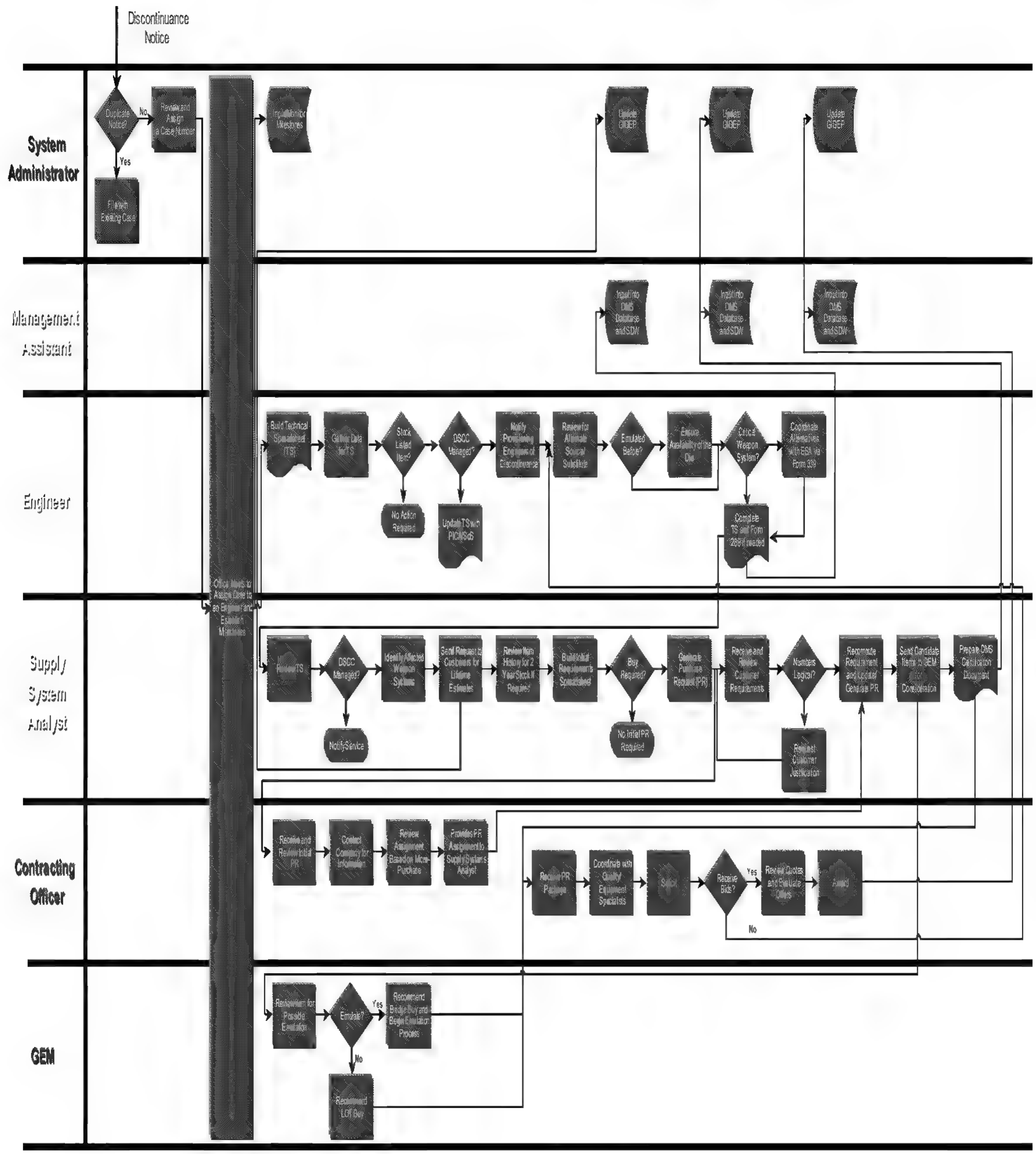
D. The Supply Systems Analyst will:

1. Review the TS.
2. Determine if the item is DSCC managed:
    a. If yes, continue to step 3.
    b. If no, notify the affected service DMSMS POC (see Appendix F).
3. Identify affected weapon systems, if applicable.
4. Send Initial Alert message (see Appendix G) requesting lifetime estimates.
5. Review item history for two-year stock decision.
6. Build initial requirements spreadsheet (see Appendix H).
7. Determine if two-year buy is required:
    a. If yes, continue to step 8.
    b. If no, no initial PR is required, skip to step 9.
8. Generate a manual purchase request (see Appendix I) and submit to the Contracting Officer.
9. Receive and review service estimates.
10. Determine if estimates are logical.
    a. If yes, continue to step 11.
    b. If no, request customer justification (see Appendix J) and return to step 9.
11. Re-compute requirements and update the existed PR or generate a new PR if required.
12. Send candidate items (see Appendix K) to GEM for consideration.
13. Prepare DMS Certification Document (see Appendix L) and obtain necessary signature.
14. Forward PR package to the Contracting Officer.
15. Forward case disposition to the Management Assistant and the System Administrator.

E. The Contracting Officer will:

1. Receive and review initial PR.
2. Contact company for information regarding the proposed. discontinuance (e.g., final production run, residual stock, surplus material, final order deadline, minimum order quantity, and available drawings) and attempt to persuade contractor to maintain production.
3. Review assignment based on micro-purchase group award criteria.
4. Provide PR assignment to the Supply Systems Analyst.
5. Receive complete PR package from Supply Systems Analyst.
6. Coordinate with Quality/Equipment Specialist for applicability of requirements.
7. Solicit/Review and evaluate quotes.
8. Award contract.

Appendix Q. New Cross-Functional Process Map



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Vita

First Lieutenant Robert E. Overstreet was born in Ellisville, Mississippi. After graduating from Beat Four High School in 1988 and spending one year at Jones County Junior College, he enlisted in the U.S. Air Force on 4 December 1989. He spent over nine years as a medical logistician. His first assignment was to the 81st Medical Group at Keesler AFB, MS. In 1995, he was selected for a special duty assignment to the prestigious 24th Special Tactics Squadron, Pope AFB, NC. While there, he earned a Bachelor of Business Administration Cum Laude from Campbell University.

In May 1999, he entered Officer Training School. Upon commissioning, he served as a Logistics Plans officer at Mountain Home AFB, Idaho. During his 13-month tour, he served as the Logistics Module (LOGMOD) Manager and the Deployments Chief.

In August 2000, he entered the Graduate Logistics Management program at the Air Force Institute of Technology. Upon graduation, he will be assigned to the Air Force Logistics Management Agency (AFLMA), Gunter Annex, Maxwell AFB, AL.

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14. ABSTRACT

With the United States military representing an ever-shrinking share of the electronics market, Diminishing Manufacturing Sources and Materiel Shortages (DMSMS) represents both a threat to mission capability as well as a large expenditure to maintain aging military weapon systems. As the primary manager of Federal Stock Classes 5961 and 5962, the Defense Supply Center, Columbus (DSCC) confronts the largest number of DMSMS cases. Their resolution of DMSMS cases affects nearly every fielded weapon system. This thesis sought to determine if the management strategy used by the DSCC could be improved.

A qualitative case study design was used to collect and evaluate the data for this effort. The products produced for the sponsor were a cross-functional process map of their DMSMS management strategy and an updated supplement to Defense Logistics Agency (DLA) Regulation 4005.6 Diminishing Manufacturing Sources and Materiel Shortages (DMSMS) Program.

Based on the evaluation of the process, the researcher's recommendations for improvement are to focus on primary output and work to decrease the call for secondary output, perform "as-requested" services for non-DSCC items, reduce the bureaucracy between DSCC and the services' Engineering Support Agencies, and provide case resolution information to the customer.

15. SUBJECT TERMS

Diminishing Manufacturing Sources and Materiel Shortages, DMSMS, DMS, Obsolescence, Reactive Strategies, Resolution Alternatives, Electronics, Microcircuits, Semiconductors

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